NUCLEAR SCIENCE ABSTRACTS

Volume 33 Number 7

Abstracts 14226-16582

April 15, 1976

FINAL VOLUME
See Notice Inside

UNITED STATES
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

REPORT COLLECTIONS IN THE UNITED STATES

The libraries listed below purchase and maintain microfiche collections of ERDA and foreign reports that are abstracted in *NSA*. Their collections also include *NSA* and its indexes, ERDA's Technical Progress Reviews, ERDA-sponsored translations, conference proceedings published by ERDA, and various bibliographic tools. Most of these libraries have microfiche reader-printers or other photocopy facilities with which to reproduce enlarged copies from microfiche. Charges for reproduction services vary.

Report collections of ERDA reports in countries other than the United States are listed on the inside back cover.

ALABAMA
Auburn, Auburn University
Tuskegee Institute, Tuskegee Institute

ARIZONA
Tucson, University of Arizona

CALIFORNIA
Davis, University of California
Los Angeles, University of California
Santa Barbara, University of California

COLORADO
Boulder, University of Colorado

DISTRICT OF COLUMBIA
Washington, Library of Congress

FLORIDA
Gainesville, University of Florida

GEORGIA
Atlanta, Georgia Institute of Technology

HAWAII
Honolulu, University of Hawaii

IDAHO
Pocatello, Idaho State University

ILLINOIS
Urbana, University of Illinois

INDIANA
Lafayette, Purdue University

IOWA
Ames, Iowa State University

KANSAS
Manhattan, Kansas State University

KENTUCKY
Lexington, University of Kentucky

MARYLAND
Baltimore, Johns Hopkins University
College Park, University of Maryland

MASSACHUSETTS
Cambridge, Massachusetts Institute of Technology
Worcester, Worcester Polytechnic Institute

MICHIGAN
Ann Arbor, University of Michigan

MISSISSIPPI
State College, Mississippi State University

MISSOURI
Columbia, University of Missouri
Kansas City, Linda Hall Library

NEW JERSEY
Princeton, Princeton University

NEW MEXICO
Albuquerque, University of New Mexico

NEW YORK
Albany, New York State Library
Albany, State University at Albany
Ithaca, Cornell University
New York, Columbia University
Rochester, University of Rochester
Syracuse, Syracuse University

NORTH CAROLINA
Raleigh, North Carolina State University

OHIO
Cincinnati, University of Cincinnati
Cleveland, Cleveland Public Library
Toledo, University of Toledo

OKLAHOMA
Norman, University of Oklahoma

PENNSYLVANIA
Philadelphia, University of Pennsylvania
Pittsburgh, Carnegie Library
University Park, Pennsylvania State University

PUERTO RICO
San Juan, University of Puerto Rico

SOUTH CAROLINA
Columbia, University of South Carolina

TENNESSEE
Knoxville, University of Tennessee

TEXAS
Austin, University of Texas
College Station, Texas A & M University
Houston, Rice University

UTAH
Salt Lake City, University of Utah

VIRGINIA
Blacksburg, Virginia Polytechnic Institute
Charlottesville, University of Virginia

WASHINGTON
Pullman, Washington State University
Seattle, University of Washington

WEST VIRGINIA
Morgantown, West Virginia University

WISCONSIN
Madison, University of Wisconsin

ERDA reports so indicated in *Nuclear Science Abstracts* are offered for sale by National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22161.

Volume 33, Number 7, April 15, 1976

NUCLEAR SCIENCE ABSTRACTS

A semimonthly publication of the USERDA Office of Public Affairs
Published by the ERDA Technical Information Center

Nuclear Science Abstracts provides the only comprehensive abstracting and indexing coverage of the international nuclear science literature. It covers scientific and technical reports of the U. S. Energy Research and Development Administration and its contractors, other U. S. Government agencies, other governments, universities, and industrial and research organizations. In addition, books, conference proceedings, individual conference papers, patents, and journal literature on a worldwide basis are abstracted and indexed. Each issue of *Nuclear Science Abstracts* includes four indexes: subject, personal author, corporate author, and report number.

The following organizations scan and abstract the nuclear science literature in their respective countries for input to the International Nuclear Information System of the International Atomic Energy Agency. By special agreement, the input to INIS is simultaneously sent to the ERDA Technical Information Center to enhance the timeliness of coverage of that literature in *Nuclear Science Abstracts*.

Atomic Energy of Canada Limited
Australian Atomic Energy Commission
Danish Atomic Energy Commission
Finnish Atomic Energy Commission
French Atomic Energy Commission
Japan Atomic Energy Bureau–Atomic Energy Research Institute
Commissie Nucleaire Informatieverzorging (Netherlands)
Institutt for Atomenergi (Norway)
Aktiebolaget Atomenergi (Sweden)
United Kingdom Atomic Energy Authority
Zentralstelle für Atomkernenergie-Dokumentation (West Germany)

Numerous organizations, societies, and publishers throughout the world provide *Nuclear Science Abstracts* with advance page-proof copy of their publications.

A list of the journals scanned regularly and the abbreviations used appears in the January 15 issue of *Nuclear Science Abstracts* and is supplemented in the July 15 issue. The January 15 issue also describes the scope and arrangement of the subject matter covered in *Nuclear Science Abstracts*. The subject matter covered is also described in TID-4552, *Subject Scope of Nuclear Science Abstracts*, available free from the USERDA Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830. An outline of the subject categories appears in the Contents of each issue.

NOTICE

The publication of *Nuclear Science Abstracts* is planned to be discontinued after Vol. 33, No. 12, dated June 30, 1976. *Atomindex*, published by the International Atomic Energy Agency and a product of the International Nuclear Information System (INIS), will provide essentially identical literature coverage, subject scope, abstracting and indexing with that of *NSA*. For all practical purposes the two journals are identical. The Energy Research and Development Administration, formerly the Atomic Energy Commission, has supported the concept and development of INIS for several years. At this time, it is quite apparent that the decentralized scanning, abstracting and indexing on a country-by-country basis is reliable and successful. Consequently, it is no longer necessary for the United States to bear the entire burden of publishing an abstract journal covering the world's nuclear literature. ERDA will continue to provide coverage of U. S. nuclear literature to INIS.

Atomindex is available on a subscription basis in the United States from UNIPUB, P. O. Box 433, Murray Hill Station, New York, New York 10016, for $150 per year including cumulative indexes. ($110 per year without cumulative indexes.) For others, *Atomindex* is available from the International Atomic Energy Agency, Publications Section, P. O. Box 590, A-1011, Vienna, Austria, at the same price.

ERDA's new journal, *ERDA Energy Research Abstracts (ERA)*, will contain abstracts and indexes to all literature of ERDA origin as well as nonnuclear energy information generated by foreign countries with which ERDA has agreements for cooperation. *ERA* is available to government agencies on the same basis as *NSA* and on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information.

The public may obtain *ERA* from the Superintendent of Documents, U. S. Government Printing Office, Washington, DC 20402. The annual subscription rate for the 12 regular issues including an annual cumulative index is $119 for domestic subscribers, and $148.75 for foreign subscribers. Individual issues will be priced at $7.40 domestic, and $9.25 foreign. Separate annual index cumulations will cost $30.50 domestic, and $38.15 foreign.

INDEXES TO *NSA*

Comprehensive indexes appear in each issue and are cumulated at the end of each volume. The report number indexes will be cumulated on both a volume and two-volume basis. Multivolume cumulations have been issued as indicated above.

All documents abstracted are indexed by subjects and personal authors. Report literature is indexed also by corporate author and report number. Each of these indexes in every issue is preceded by an introduction explaining in detail the organization of the index and the principles by which it is compiled. The reader is referred to these explanations for information not found in the brief summaries below.

Personal Authors

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

SOLDAN, D.W., Shipping container for a bottle of radioactive material, 32:20442
SOLDAT, J.K., Dosimetry of the radioactive noble gases, 32:19918 (BNWL-SA-4813)
SOLOMAKHA, D.A., Measurement of the 1.15-μm wavelength of a helium--neon laser, 32:19555

Subjects

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

Examples:

URANIUM ORES/GEOCHEMISTRY
Change of uranium concentration in plagioclase of various zones of microcline--albite--oligoclase pegmatites of Karelia, 32:19704
URANIUM ORES/LEACHING
Preparation of uranium compounds (Patent), 32:19329
URANIUM ORES/MINING
The uranium mining and its importance for the energy supply, 32:19701
URANIUM ORES/ORE PROCESSING
Supplies for the fuel cycle for Spanish nuclear power plants, 32:19702
URANIUM OXIDES
See also URANIUM DIOXIDE
URANIUM OXIDES U3O8

Corporates

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

20457 (LA-5954) 100-MHz POWER AMPLIFIER DESIGN AND CONTROL FOR A HEAVY-ION ACCELERATOR, Lunsford, J. S.; Shipley, J. P.; Sutton, J. **(Los Alamos Scientific Lab., N. Mex. (USA)).** Jul 1975, 11p. Dep. NTIS $4.00.

is indexed as:

LOS ALAMOS SCIENTIFIC LAB., N.MEX. (USA)
100-MHz power amplifier design and control for a heavy-ion accelerator, 32:20457 (LA-5954)
Characterization of transuranic solid wastes from a plutonium processing facility, 32:19398 (LA-5993-MS)
Electrical breakdown and tracking characteristics of pulsed high voltages in cryogenic helium and nitrogen, 32:19495 (LA-UR-75-1032)
Engineering concepts for laser-fusion reactor applications, 32:19493 (LA-UR-75-736)
Evaluation of pre-impregnated resin-glass systems for insulating superconducting magnets, 32:19583 (LA-UR-75-1099)

Report Numbers

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. While not reports, patents and conference papers are indexed here as a matter of convenience.

L- (Misc.)		
9389	32:20494	See N-74-35219
LA-		
2429	32:20210	Dep. NTIS, $12.00
5931	32:21563	Dep. NTIS, $5.45
LA-tr-		
75-14	32:21506	Dep. NTIS, $7.75
75-26	32:19253	Dep. NTIS, $4.00
LA-UR-		
75-736	32:19493	Dep. NTIS, $4.00
75-791	32:20772	Dep. NTIS, $4.50
75-1331	32:19238	Dep. NTIS, $4.00
LBL-		
2874	32:19889	Dep. NTIS, $9.25
3633	32:21097	Dep. NTIS, $13.50
LFEN-	(Portugal)	
165-b	32:21507	INIS

AVAILABILITY OF PUBLICATIONS ABSTRACTED

Public availability of all U. S. Energy Research and Development Administration reports is indicated in the report number indexes. The availability of other reports, when known, is also indicated. The availability of some unnumbered reports is given in the abstract.

Dissertations from *Dissertation Abstracts International, Part B* that are included in *Nuclear Science Abstracts* are available from Xerox University Microfilms, 300 North Zeeb Road, Ann Arbor, Michigan 48106.

Information on the availability of the published literature and unpublished conference papers abstracted in *Nuclear Science Abstracts* can be obtained from the USERDA Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

TABLE OF CONTENTS

Volume 33, Number 7, April 15, 1976

Category	Page
CHEMISTRY	1457
Analytical and Separations Chemistry	1457
Activation and Nuclear Reaction Procedures	1457
Chemical and Spectral Procedures	1458
Radiometric and Radiochemical Procedures	1459
Separation Procedures	1460
Inorganic, Organic, and Physical Chemistry	1461
Chemical and Physicochemical Properties	1461
Isotope Effects	1462
Isotope Exchange and Isotope Separation	1463
Feed Materials Processing	1464
Radiation Chemistry	1464
Radiochemistry and Nuclear Chemistry	1466
Hot-Atom Chemistry	1467
Properties of Radioactive Materials	1467
Radioactive Waste Treatment	1469
Radioisotope Production	1470
Reactor Fuel Reprocessing	1470
CONTROLLED THERMONUCLEAR RESEARCH	1472
Plasma Confinement and Heating	1472
Plasma Diagnostics	1477
Plasma Kinetics (General)	1479
Plasma Kinetics (Experimental)	1480
Plasma Kinetics (Theoretical)	1481
Plasma Production	1484
Plasma Stability	1485
Thermonuclear Engineering and Equipment	1488
Wave Phenomena	1496
ENGINEERING	1500
Energy Conversion	1500
Facilities and Equipment	1500
Lasers	1500
Cryogenic and Superconducting Equipment and Devices	1513
Heat Transfer and Fluid Flow	1514
Materials Testing	1516
Nuclear Explosions	1517
Protective Structures and Equipment	1518
ENVIRONMENTAL AND EARTH SCIENCES	1519
Minerals and Ores	1519
Radioactivity Monitoring and Transport	1520
Atmosphere	1520
Soil	1522
Water	1522
Ecosystems and Food Cycles	1522
Radiometric Techniques	1523
Site Surveys	1523
Thermal Effluents	1524
Chemical Effluents	1525
INSTRUMENTATION	1526
Radiation Detection Instruments	1526
General Detectors and Monitors	1526
Radiation Dosimeters	1529
Nuclear Spectroscopic Instrumentation	1530
High Energy Physics Instrumentation	1531
Radiometric Instruments	1532
Radiation Effects on Instrument Components, Instruments, or Electronic Systems	1534
Miscellaneous Instruments	1535
ISOTOPE AND RADIATION SOURCE TECHNOLOGY	1537
Isotope Separation (Industrial)	1537
Isotopic Power Sources	1538
Radiation Sources	1538
Design and Fabrication	1539
Industrial Uses	1540
LIFE SCIENCES	1541
Radiation Effects on Biochemicals	1541
Radiation Effects on Cells	1542
Radiation Effects on Microorganisms	1543
Radiation Effects on Plants	1545
Radiation Effects on Animals	1545
Man	1545
Vertebrates	1546
Invertebrates	1548
Radionuclide Effects (Internal Source)	1549
Man	1549
Animals	1550
Plants	1550
Nuclide Kinetics and Toxicology	1550
Man	1550
Animals	1550
New Tracer Techniques	1550
MATERIALS	1557
Ceramics and Cermets	1557
Metals and Alloys	1562
Corrosion and Erosion	1562
Preparation and Fabrication	1564
Properties, Structure, and Phase Studies	1566
Radiation Effects	1573
Other Materials	1574
NUCLEAR MATERIALS AND WASTE MANAGEMENT	1579
Accountability and Safeguards	1579
Disposal and Storage	1579
Handling Equipment and Procedures	1579
Transportation	1580

TABLE OF CONTENTS (continued)

Category	Page
PARTICLE ACCELERATORS	1581
Design, Development, and Operation	1581
Auxiliaries and Components	1581
Ion Sources and Injection and Extraction Systems	1583
Ion Optics and Field Calculations	1583
Storage Rings	1584
Experimental Facilities	1584
PHYSICS (ASTROPHYSICS AND COSMOLOGY)	1585
Cosmic Radiation	1585
Stars	1585
Quasi-Stellar, Radio, and X-Ray Sources	1587
Solar Phenomena	1589
Galaxies	1589
Cosmology	1593
Planetary Phenomena	1594
PHYSICS (ATMOSPHERIC)	1595
Auroral and Ionospheric Phenomena	1595
Magnetospheric Phenomena	1596
PHYSICS (ATOMIC AND MOLECULAR)	1598
Beams and Their Reactions	1598
Atomic and Molecular Properties	1601
Positronium, Muonium, and Muonic and Mesic Atoms and Molecules	1605
Collision Phenomena	1606
Atomic Theory	1612
PHYSICS (ELECTROFLUID AND MAGNETOFLUID)	1614
PHYSICS (HIGH-ENERGY)	1615
Particle Interactions and Properties (Experimental)	1615
Electromagnetic	1615
Weak	1615
Strong (Baryon-induced)	1616
Strong (Meson-induced)	1616
Particle Interactions and Properties (Theoretical)	1618
General	1618
Electromagnetic	1620
Weak	1623
Strong (General)	1624
Strong (Baryon No. = 0)	1625
Strong (Baryon No. = 1)	1625
Strong (Baryon No. ≥ 2)	1626
Particle Invariance Principles and Symmetries	1627
General	1627
Applications (Electromagnetic and Weak)	1627
Applications (Strong)	1628
Scattering Theory	1628
PHYSICS (LOW-TEMPERATURE)	1630
Superconductivity	1630
PHYSICS (NUCLEAR)	1632
Neutron Interactions with Matter	1632
Nuclear Properties and Reactions, A < 5	1633
PHYSICS (NUCLEAR) (Cont'd.)	
Nuclear Properties and Reactions, 6 < A < 19	1634
Nuclear Properties and Reactions, 20 < A < 38	1636
Nuclear Properties and Reactions, 39 < A < 58	1637
Nuclear Properties and Reactions, 59 < A < 89	1639
Nuclear Properties and Reactions, 90 < A < 149	1640
Nuclear Properties and Reactions, 150 < A < 189	1642
Nuclear Properties and Reactions, 190 < A < 219	1643
Nuclear Properties and Reactions, A > 220	1645
Nuclear Theory	1646
PHYSICS (RADIATION AND SHIELDING)	1651
Radiation Physics	1651
Radiation Protection Standards	1653
Radiation Source Calibration and Standardization	1653
Shielding Calculations and Experiments	1653
PHYSICS (THEORETICAL)	1655
General	1655
Quantum Field Theories	1656
Gravitation and General Relativity	1661
REACTOR TECHNOLOGY AND REGULATION	1664
Power Reactors, Non-Breeding, BWR-Type	1664
Power Reactors, Non-Breeding, PWR-Type	1665
Power Reactors, Non-Breeding, Graphite Moderated	1666
Power Reactors, Non-Breeding, Otherwise Moderated	1668
Power Reactors, Breeding	1668
Research, Test, and Experimental Reactors	1675
Production and Materials Testing and Processing Reactors	1677
Propulsion and Package Reactors	1677
Reactor Safety and Environmental Aspects	1679
Reactor Theory and Calculation	1685
Reactor Components and Accessories	1688
Reactor Fuels	1690
Reactor Control Systems	1692
Nuclear Power Plant Economics	1692
Reactor Fuel Cycle Economics	1693
Reactor Licensing and Regulation	1694
GENERAL AND MISCELLANEOUS	1696
Information Handling	1696
Law	1696
Management	1696
Mathematics and Computers	1696
CORPORATE INDEX	INDEX-1
PERSONAL AUTHOR INDEX	INDEX-13
SUBJECT INDEX	INDEX-54
REPORT NUMBER INDEX	INDEX-147

STAFF OF NUCLEAR SCIENCE ABSTRACTS

Editor and Production Manager
David E. Bost

Assistant Editor
Lee M. Thompson

Associate Editors
M. Catherine Grissom
Robert C. Kelly
Sidney F. Lanier
Henry D. Raleigh
Charles E. Stuber

Report Evaluators
John H. Mitchell
Mary H. Newman

Descriptive Cataloging Specialist
J. Paul Meredith

Subject Heading Specialist
Dora H. Moneyhun

Corporate Author Specialist
Clara L. Fox

Report Number Specialist
Helen W. White

Information Specialists
P. Martin Alexander
E. Ray Bedford
Jane G. Buchanan
D. Lamar Cason
David C. Cunningham
Theodore F. Davis
James R. Dulaney
Stanley D. Frey
Darrell O. Galde
Martha W. Gerrard
Barbara J. Glenn
Everett J. Hoffman
Carolyn D. Houston
Lynda H. Kern
W. Hugh Kinser
Lisbeth C. Lieberman
William D. Matheny
Lorne T. Newman
Jean F. Peckham
Mona H. Raridon
Julia S. Redford
Stanley J. Rimshaw
Jessie W. Rushing
Robert W. Rutkowski
Francis L. Sachs
Lila B. Smith
Polly C. Summers
George H. Thoeming
Helen L. Ward
Lawrence T. Whitehead
Milton O. Whitson
Martha C. Wilson

Publishing Coordinator
Charles R. Bruce

Computer Processing Coordinator
Noboru Kawakami

Communication concerning the editorial policy and content of *Nuclear Science Abstracts* should be addressed to the Editor, *Nuclear Science Abstracts*, USERDA Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

The Administrator of the Energy Research and Development Administration has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1978.

Volume 33, Number 7 April 15, 1976

NUCLEAR SCIENCE ABSTRACTS

CHEMISTRY

Analytical and Separations Chemistry

Refer also to abstracts 14829 and 15367.

14226 (BNWL-tr-162) NONDESTRUCTIVE METHOD FOR THE DETERMINATION OF THE O/Me RATIO IN PLUTONIUM BEARING OXIDE FUEL. Vollath, D. (Kernforschungszentrum Karlsruhe (F. R. Germany)). 2 Dec 1975. Translation by B. Russell of KFK-2097. 20p. Dep. NTIS $3.50.

A new nondestruction method for the measurement of the oxygen-to-metal ratio in mixed oxide fuel is reported. It is based on the measurement of the oxygen potential of the samples electrochemically and the determination of the ratio from a calibration curve. With a probability of 99.5 percent the error of the method is less than DELTA O/Me equals 0.005. The method can be automated. (JSR)

14227 (COM-75-50070) STANDARD REFERENCE MATERIALS: THE ROLE OF SRM'S IN MEASUREMENT SYSTEMS. Final Report. Cali, J. P.; Mears, T. W.; Michaelis, R. E.; Reed, W. P.; Seward, R. W. (National Bureau of Standards, Washington, D. C. (USA)). Jan 1975. 57p. (NBS-MN-148). GPO.

This publication is a guide to the use of Standard Reference Materials (SRM's) and should be useful to all users of SRM's, particularly those in countries developing national measurement systems. It is not intended to be an exhaustive description of the NBS-SRM program, but rather a review of the role SRM's play in the measurement system, how SRM's are certified, and what the certification means. To illustrate the use of SRM's several selected industries are described in which SRM's have made significant contributions. (GRA)

14228 SOME NEW MICROCHEMICAL TECHNIQUES USED IN THE PREPARATION AND STUDY OF TRANSPLUTONIUM ELEMENTS AND COMPOUNDS. Stevenson, J. N.; Peterson, J. R. (Univ. of Tennessee, Knoxville). Microchem. J.; 20: 213-220(1975).

Six new systems were developed to prepare and study transplutonium elements and compounds. Detailed descriptions of the systems were given along with pictures or diagrams. The newly developed trifluoride reduction crucible permitted preparation of the transplutonium metal in higher than usual yield. Three annealing systems were designed to study thermal properties. A pressure vacuum reaction chamber was constructed to prepare compounds, and an x-ray powder diffraction camera was modified for use in high temperature analysis.

Activation and Nuclear Reaction Procedures

Refer also to abstract 15007.

14229 (AEC-tr-7315, pp 123-130) NEUTRON-RESONANCE ANALYSIS OF NOBLE METALS BY THE MODERATION TIME OF NEUTRONS. Gambaryan, R. G.; Shpanov, A. P.; Shtan, A. S. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

In a study of the possibility of capture neutron resonance analysis, measurements were carried out on the assembly FIAN of the time dependence of the intensity of capture gamma-rays for Au, Ag, Pd, and Pb and some samples of concentrates. Results of these investigations are given. (LK)

14230 (AEC-tr-7315, pp 217-225) BASIC TECHNICO-ECONOMICAL INDICATORS OF EQUIPMENT WITH SAMPLER FOR THE NEUTRON-ACTIVATION ANALYSIS OF MATERIALS. Smirnova, Z. M.; Semenova, I. D.; Nikolaenko, O. K. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

The technico-economical indicators of the equipment with sampler for neutron activation analysis of materials was determined. A classification of the technical parameters and economical indicators was carried out, and the interrelationships among these indicators were recognized. The technico-economical indicators were classified according to the characteristics of the developed neutron activation equipment for the quick analysis of metals for oxygen and for oxygen and nitrogen. (LK)

14231 (FRNC-TH-548) MULTI-ELEMENT NEUTRON ACTIVATION ANALYSIS OF BIOLOGICAL TISSUES: CONTRIBUTION TO THE STUDY OF TRACE ELEMENT ACCUMULATION AS A FUNCTION OF AGING. Gaudry, A. (Paris-6 Univ., 75 (France)). 1975. 154p. (In French). INIS.

The accumulation of trace elements in various organs as a function of age was studied in rats, in connection with tissue aging phenomena. Part one reviews the various methods available to develop a programme of simultaneous multi-element analysis in biological matrices. Part two studies the precision and accuracy offered by neutron activation analysis. Special attention is paid to the problem of sample contamination by the silica glass irradiation supports. The possible causes of this effect are mentioned and a procedure limiting its harmful influence is proposed. Part three defines the restrictions introduced by the use of a method to separate the activable matrix. The fourth and last chapter describes the development of a multielement chemical separation system, designed to work semiautomatically for the simultaneous treatment of three samples and a standard in a shielded cell of small dimensions. The principles of a multicomparator calibration where a knowledge of certain conventional but imprecise nuclear data is unnecessary owing to an experimental expedient are outlined briefly. Finally the separation method is tried out on various biological samples, including a reference (bovine liver SRM1577-NBS), and some results are given. (FR)

14232 (INIS-mf-1845) SURFACE ANALYSIS IN METALS BY MEANS OF CHARGED PARTICLE INDUCED REACTIONS. Lorenzen, J. (Uppsala Univ. (Sweden)). 1975. 38p. INIS.

Thesis.

Some experimental investigations are described which add to the analytical techniques for the quantitative measurement of low concentrations and their depth determination in metal surfaces by means of charged-particle-induced reactions. The methods described are Rutherford scattering analysis, ion-induced x-ray emission analysis, and nuclear reaction analysis. Sectioning techniques, scanning techniques and resonance and nonresonant reactions are described for depth distribution studies. (INIS)

14233 (LYCEN-7523) TARGET CHAMBER DESIGNED FOR ADSORPTION STUDIES USING CHARGED-PARTICLE INDUCED NUCLEAR REACTIONS. Chartoire, M.; Engerran, J.; Thomas, J. P.; Tousset, J.; Bussiere, P. (Lyon-1 Univ., 69-Villeurbanne (France)). Mar 1975. 17p. Dep. NTIS (US Sales Only) $3.50.

Charged particle induced nuclear reactions at low energy are particularly suited for surface determination of small

amounts of light elements. The adsorption of carbon and oxygen can be followed in this way when the environment of the sample is not subject to external contamination. A target chamber for ultra high and controlled vacuum has been designed for this purpose, the main feature being the use of thin metallic windows insulating the chamber from the beam line and the detection system. Due to the nature of the detected events (charged particles from (d,p) reactions) the distortion of the obtained spectra does not prevent quantitative determination of the two elements detected on the sample. Moreover these windows allow the complete disconnection of the chamber from the beam line and the detector assembly during the necessary baking (outgassing of the walls). Preliminary results on a $CO/O_2/N_2$ gas mixture adsorbed on a polycrystalline platinum sample are given showing an excess of carbon during the process. Limitations and improvements of the system and the method are discussed. (auth)

14234 (PB-239348) IDENTIFICATION AND EVALUATION OF WATER TRACERS AMENABLE TO POST-SAMPLING NEUTRON ACTIVATION ANALYSIS. Jester, W. A.; Uhler, K. A. (Pennsylvania State Univ., University Park (USA). Inst. for Research on Land and Water Resources). Sep 1974. Contract DI-14-31-0001-5038. 97p. NTIS $4.75.

The halogen ions $Br^{(-)}$, $I^{(-)}$, and $Cl^{(-)}$ appear to be suitable water tracers for use in waters having a pH range between pH 5 and pH 8 with neutron activation analysis. The bromide and iodide ions can experience very great dilutions and still be detected above normal background concentrations. Sensitivities and detection limits are variable and depend upon background concentrations and maximum allowable tracer concentrations. In very acid waters the vanadium and cobaltous ions appear to offer promise, with the divalent cation of vanadium offering the greater sensitivity of the two. Bromides and chlorides appear to be reliable in this pH range with the same limits of detection as at more neutral pH values. Successful application of these tracer techniques is strongly dependent on activation analysis of the carrier water to determine background concentrations of the tracers. (GRA)

14235 EXPERIMENTS ON THE POSSIBLE USE OF THE 2.31-MeV γ RAY OF SECOND ^{14}O FOR ACTIVATION ANALYSIS OF OXYGEN. Buneo De Mesquita, K. G.; Bijl, J. A.; Lindner, L. (Instituut voor Kernphysisch Onderzoek, Amsterdam). Int. J. Appl. Radiat. Isot.; 26: No. 9, 551-557(Sep 1975).

The potential of the reactions $^{16}O(p,p2n)^{14}O$ and $^{16}O(\gamma,2n)^{14}O$ for the activation analysis oxygen, is reported. The advantages of using ^{14}O for this technique is the γ-ray (99%) energy of 2.31 MeV and the comparatively long half-life of 70.6 sec. Gamma spectra of H_2O irradiated with 50-MeV protons are shown and the problem of the suppression of an unwanted peak at 511 keV is discussed. The standardization and sensitivity of the system are considered. Due to the potentially important interference in the oxygen determination by the presence of nitrogen in case of activation by protons it is considered that if the presence of nitrogen is expected photon activation according to $^{16}O(\gamma,2n)^{14}O$ should be the method of choice. (UK)

14236 ACTIVATION DETERMINATION OF IRON BY THE (n,p) REACTION IN FAST-NEUTRON REACTORS. Akbarov, U.; Gulyamov, U. G.; Uzakova, U.; Umirbekov, K.; Yankovskii, A. V. (Inst. of Nuclear Physics, Tashkent). Izv. Akad. Nauk Uzb. SSR, Ser. Fiz.-Mat. Nauk; No. 3, 63-65(1975). (In Russian).

A method for determining iron by the (n,p) reaction in rocks and natural waters using Cd–B filters is described. Irradiation of samples of up to 200 mg in a neutron flux of 1.8×10^{13} n/cm^2.sec for 20 hr in a combined filter gives a high sensitivity of determination of iron from the ^{54}Mn isotope by its selective activation relative to the interfering isotopes ^{46}Sc, ^{65}Zn, ^{60}Co, and ^{124}Sb. The sensitivity of the iron determination is 10^{-6} g. (tr-auth)

14237 CALCULATIONAL FORMULA FOR DISTRIBUTION OF GAMMA INTENSITY IN ACTIVATION ANALYSIS OF SAMPLES USING AMPOULE NEUTRON SOURCES. Abdullaev, Ya. S.; Sandmuradov, T. (Inst. of Nuclear Physics, Tashkent). Izv. Akad. Nauk Uzb. SSR, Ser. Fiz.-Mat. Nauk; No. 3, 52-57(1975). (In Russian).

The basis of and results from an equation for distribution of gamma intensity in activation analysis of large-volume samples, using ampoule neutron-source radiation, are presented. The behavior of the coefficient of linear absorption entering into the basic equation was studied experimentally. Comparative data on the determination of trace impurities, indicating the usefulness of the formulas given, are presented. (tr-auth)

14238 DETERMINATION OF LANTHANUM IN THE PRESENCE OF URANIUM BY NEUTRON ACTIVATION ANALYSIS USING HIGH RESOLUTION GAMMA SPECTROMETRY. Lavi, N. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). Radiochim. Acta; 21: No. 1, 73-74(1974).

2 figs.; 1 tab.; 7 refs.

An accurate determination of lanthanum in a mixture of lanthanum and uranium is described. The ^{140}La activity produced from both natural lanthanum and ^{140}Ba, a fission product of uranium, was determined using high resolution gamma spectrometry. Ratios of 539 and 415 were obtained by irradiating equal quantities of natural lanthanum and uranium without and with cadmium cover, respectively, for 24 h and taking measurements 32 h after irradiation. The accuracy is generally better than ±5%. (DE)

14239 MULTIELEMENT PHOTON ACTIVATION ANALYSIS OF ROCK MATERIALS WITH 30 MeV BREMSSTRAHLUNG. Sato, N.; Kato, T.; Suzuki, N. (Iwate Univ., Morioka (Japan). Coll. of General Education; Tohoku Univ., Sendai (Japan). Faculty of Science). Radiochim. Acta; 21: No. 1, 63-68(1974).

1 fig.; 4 tabs.; 25 refs.

Nondestructive photon activation analysis with high-resolution gamma spectrometry has been used to determine 6 major and 8 minor elements in USGS G-1 and W-1 rocks and in Japanese standard rocks JG-1 and JB-1. The rock sample and the multielement standards were irradiated simultaneously with 30 MeV bremsstrahlung and the (γ,n) and (γ,p) reaction products were measured with a Ge(Li) detector. Elements found suitable for determination by this method include sodium, magnesium, calcium, titanium, manganese, iron, cobalt, rubidium, strontium, yttrium, zirconium, niobium, cerium, and barium. The abundance values obtained are in good agreement with published data. (DE)

14240 JOINT USE OF LIGHT, X-RAY, AND NEUTRON SCATTERING FOR INVESTIGATION OF RNA AND PROTEIN MUTUAL DISTRIBUTION WITHIN THE 50S SUBPARTICLE OF E. COLI RIBOSOMES. Serdyuk, I. N.; Grenader, A. K. (Inst. of Protein Research, Moscow). FEBS (Fed. Eur. Biochem. Soc.) Lett.; 59: No. 1, 133-136(Nov 1975).

In E. coli ribosomal 50S subparticles, the RNA component is, on the average, located nearer to the center of the particle than is the protein component. This conclusion was based on a comparison of the diffusion coefficient of these subparticles with small-angle X-ray scattering data. The aim of this paper is to use the possibilities of a new approach based on the joint use of light, X-ray and neutron scattering to obtain quantitative parameters characterizing the distribution of RNA and protein in the 50S subparticle. Analysis of the parameters obtained unambiguously indicates the preferential localization of RNA in the center of the 50S subparticle. (auth)

Chemical and Spectral Procedures

Refer also to abstracts 14953 and 15338.

14241 (AD/A-007136) APPLICATION OF ATOMIC ABSORPTION SPECTROPHOTOMETRY TO THE ANALYSIS OF MOLYBDENUM IN HIGH-ALLOY STEELS. Peterson, E. A. (Rock Island Arsenal, Ill. (USA). General Thomas J. Rodman Lab.). Aug 1974. 10p. (RIA-R-TR-74-035). NTIS $3.25.

A method is described of an analysis for molybdenum from 2 to 10% in high-alloy steels in which aqueous standards are used. Sample dissolution, standard preparation, and instrument parameters are described. Determinations of molybdenum in National Bureau of Standard samples by this method yielded acceptable results. (GRA)

14242 (TIM-907) NEW CUPROUS REAGENT FOR THE SPECTROPHOTOMETRIC DETERMINATION OF ACETYLENE. Hobart, E. W.; Bjork, R. G.; Katz, R. (Pratt and Whitney Aircraft, Middletown, Conn. (USA)). 9 Mar 1966. Contract AT (30-1)-2789. 11p. Dep. NTIS $3.50.

A new spectrophotometric reagent for determining acetylene has been developed. This reagent consists of an acetate-buffered cuprous solution stabilized by gelatin and potassium chloride. Addition of acetylene in acetone to this reagent produces a red color which is stable for at least three days. By trapping acetylene in acetone at −78°C, the method can be used for determining acetylene in gases. Recoveries of 97 ± 2 percent of known quantities of acetylene, trapped from a gas stream, have been obtained. (auth)

14243 DETERMINATION OF ^{125}I AND ^{129}I USING AN INTRINSIC GERMANIUM DETECTOR FOR X-RAY SPECTROSCOPY. Daly, J. C.; Paperiello, C. J.; Goodyear, S.; Matuszek, J. M. (New York State Dept. of Health, Albany). Health Phys.; 29: No. 5, 753-760(Nov 1975).

An analytical method for the determination of ^{125}I and ^{129}I in environmental samples is described. Samples are treated to

convert all iodine to a common oxidation state prior to chemical separation and purification. The iodine is reduced to I_2; then the elemental iodine is extracted into CCl_4, back extracted into water and precipitated as PdI_2. The chemical recovery is determined gravimetrically. The PdI_2 precipitate is counted on an intrinsic-germanium detector, and the intensities of the K_α x-rays from ^{125}I and ^{129}I are measured. A matrix solution is used to correct for the interference of one spectral region to the other. If ^{131}I is present, as indicated by an independent measurement, a correction for ^{131}I interference is also made. (auth)

14244 USE OF LONG CHAIN ALKYLAMINES FOR PRECONCENTRATION OF TRACES OF MOLYBDENUM, TUNGSTEN, AND RHENIUM IN THEIR DETERMINATION BY ATOMIC-ABSORPTION SPECTROSCOPY. Kim, C. H.; Alexander, P. W.; Smythe, L. E. (New South Wales Univ., Kensington, Australia). Talanta; 22: No. 9, 739-744(Sep 1975).

Long-chain alkylamines are used for the preconcentration of traces of molybdenum, tungsten and rhenium as thiocyanate complexes, in their determination by atomic-absorption spectroscopy. General studies of factors influencing the extraction show that the thiocyanate complexes can be extracted into chloroform containing a low concentration of Amberlite LA 1. Detection limits are 0.02 ppm Mo, 0.75 ppm W and 0.34 ppm Re in the final MIBK solution and are improved by a factor of 5 to 10 over those obtained by using current extraction methods. Serious interelement effects are eliminated and a range of other cations and anions are shown to have little effect on the absorption. (auth)

14245 SPECTROPHOTOMETRIC SOLVENT EXTRACTION STUDIES OF 2-MERCAPTOPYRIDINE-1-OXIDE AND URANYL ION COMPLEX. Edrissi, M. (Inst. of Chemical Engineering, Teheran); Massoumi, A. Talanta; 22: No. 8, 693-694(Aug 1975).

The complex formed by uranyl ion with 2-mercaptopyridine-1-oxide (thione) is studied by spectrophotometry. At pH 4.5 and 25° the only complex formed is $UO_2(thione)_3^-$. The conditional stability constant of this complex is 2.6×10^{12}. Tributyl phosphate is used for the extraction of the complex from the aqueous phase and the extraction constant is 8.9×10^{12}. The use of the reagent for the separation and determination of uranyl ion is elaborated. (auth)

14246 EQUILIBRIUM EFFECTS IN THE DETERMINATION OF TANTALUM BY ATOMIC-ABSORPTION SPECTROSCOPY. Pickering, W. F. (New South Wales Univ., Kensington, Australia); Thomas, P. Talanta; 22: No. 8, 691-693(Aug 1975).

The effect of solution variables on the efficiency of tantalum atom formation in hot flames is considered in terms of competing equilibra. (auth)

14247 ION PROBE MICROANALYSIS. Liebl, H. (Max-Planck-Institut fuer Plasmaphysik, Garching, Ger.). J. Phys., E (London); 8: No. 10, 797-808(Oct 1975).

Ion probe microanalysis has evolved as a new technique for characterization of solid samples with high spatial resolution. It complements electron probe microanalysis for elemental analysis in the range of low concentrations and in its applicability for all elements. Furthermore, its scope of application includes in-depth concentration profiling, isotopic analysis for the study of transport phenomena with stable tracer isotopes and for radiometric in-situ age dating of mineral samples, and the identification of compounds by their fingerprint spectra. A review of the evolution of presently available instrumentation is given, aspects of qualitative and quantitative analysis and of the sensitivity in conjunction with sample consumption are discussed, examples of applications are listed, and trends in further development are briefly touched on. (auth)

14248 ALTERNATIVE SET OF CONDITIONS FOR MOLYBDENUM DETERMINATION BY ATOMIC ABSORPTION SPECTROPHOTOMETRY. Edgar, R. M. At. Absorpt. Newsl.; 14: No. 3, 68-69(Jun 1975).

In comparing a newly developed procedure with that recommended by Perkin-Elmer, et al., (Analytical Methods for Atomic Absorption Spectrophotometry, Perkin-Elmer Corp., Norwalk, Conn. 1973) two areas were found in which the new procedure appeared more suitable for Mo determination. If Cr is present in concentrations greater than 100 ppM, the recommended procedure results in an enhancement effect on Mo absorption. This erroneously high result is eliminated when the new procedure is followed. In the recommended procedure, when the sample has to be dissolved in hydrofluoric acid and Al is added to help eliminate interferences, the acid combines with the Al to form insoluble aluminum fluoride. The part that Al plays in eliminating interferences is lessened, because it is no longer in solution. (Metals Abstr.)

14249 ATOMIC ABSORPTION DETERMINATION OF LITHIUM, SODIUM, CALCIUM, MAGNESIUM, MANGANESE, STRONTIUM, COPPER, NICKEL, ZINC, CHROMIUM, AND IRON IN ROCKS AND MINERALS. Kexue Tongbao (Scientia) (Engl. Transl.); 18: No. 1, 31-33(Jul 1973).

Translated from Kexue Tongbao; 18: No. 1, 27-29(Jul 1973).

Lithium, sodium, calcium, magnesium, manganese, strontium, copper, nickel, zinc, chromium, and iron were determined in rocks and minerals by atomic absorption spectroscopy using an air-acetylene flame. Interference from interaction between elements in the flame was avoided by adding $SrCl_2$ (for Ca and Mg), $NaSo_4$ (for Cr), and $CaCl_2$ (for Sr) to samples and standards.

14250 ELEMENTAL ANALYSIS WITH AUGER ELECTRON SPECTROSCOPY AND SECONDARY ION MASS SPECTROMETRY. Morabito, J. M. (Bell Telephone Labs., Inc., Allentown, Pa). pp 139-152 of Electron and Ion Beam Science and Technology. Bakish, R. (ed.). Princeton, NJ; Electrochemical Society, Inc. (1974).

From 6th international conference on electron and ion beam science and technology; San Francisco, California, USA (12 May 1974). See CONF-740515-.

The capabilities and limitations of Auger electron spectroscopy (AES) and secondary ion mass spectrometry (SIMS) for surface analysis, depth profile analysis, and quantitative analysis are compared. Tantalum nitride, tantalum oxynitride, and doped Si films were used to demonstrate the complementary nature of the two techniques. It is noted that at present AES appears to be the less ambiguous analysis technique for quantitative analysis. However, its detection sensitivity is 1 to .1 at. percent, whereas SIMS can detect concentrations two to five orders of magnitude lower depending on secondary ion yield. Consequently, only SIMS can determine concentration distributions at most dopant levels of interest in semiconductor device technology provided the area available for analysis is sufficient. (auth)

14251 USE OF SILVER OXIDE(II) FOR THE TITRATION OF PLUTONIUM. Cauchetier, P.; Guichard, C.; Regnaud, F. (CEA-CEN, Fontenay-aux-Roses, France). Anal. Chim. Acta; 80: No. 1, 188-191(Nov 1975). (In French).

14252 MICROANALYSIS OF LIGHT ELEMENTS USING TRANSMITTED ENERGY LOSS ELECTRONS. Isaacson, M. (Univ. of Chicago); Johnson, D. Ultramicroscopy; 1: No. 1, 33-52(Jul 1975).

The use of transmitted energy loss electrons is shown to hold considerable promise for the elemental analysis of light elements. In this technique, those electrons which have lost energy in exciting characteristic inner shell atomic levels are detected rather than x-rays resulting from the decay of the excited levels. The advantages of this technique are (1) a large fraction (0.1-1) of the information-carrying energy loss electrons can be detected, and (2) for each excited level, one energy loss electron is produced independent of the fluorescent yield. Thus the technique potentially offers higher sensitivity than x-ray analysis. A program was begun to evaluate this technique both theoretically and experimentally for electron probe devices. First, the necessary framework to make predictions concerning relevant quantities of elemental analysis was developed such as the minimum detectable mass (MDM) and the minimum detectable mass fraction (MMF). The results of these calculations for thin specimens indicate a potential reduction in the MDM by up to three orders of magnitude and in the MMF by up to 500 through the use of transmitted energy loss electrons rather than x-rays, the advantage over x-ray detection being greater for lower atomic number. Second, experimental measurements were begun to verify certain predictions. These experiments were performed in a field emission scanning microscope with known limitations in collection efficiency, but the results indicate the validity of the basic assumptions and also aid in the design of an instrument which can fully exploit this technique. The experimental results obtained indicate the ease of detection of characteristic K-shell energy levels in elements as light as lithium and indicate the mass detectability of less than 10-18 g. (NL)

14253 REPORT ON A SYMPOSIUM ON CONTRAST PROBLEMS IN TRANSMISSION ELECTRON MICROSCOPY. Johansen, B. V. (National Inst. of Public Health, Oslo); Hoeglund, S. Ultramicroscopy; 1: No. 1, 83-87(Jul 1975).

Radiometric and Radiochemical Procedures

Refer also to abstracts 14299, 14792, 14848, 14899–14901, 14959, 14962, 14965, and 15143.

14254 (AEC-tr-7315, pp 130-140) X-RAY RADIOMETRIC ANALYSIS OF POWDERED SAMPLES OF COPPER ORES FOR

COPPER AND IRON. Mamikonyan, S. V.; Kozlov, O. V.; Filatov, V. I. 1971. Translated from Radiats. Tekh.; No. 6, (1971).
In Radiation Technology, Issue 6.
The results of application of the proportional counter SI-6R with the sources Ti-Zr, ^{241}Am, ^{109}Cd, and ^{170}Tm in the x-ray radiometric analysis for copper and iron are discussed. (LK)

14255 (AEC-tr-7315, pp 140-144) USE OF SOME RADIOISOTOPE SOURCES FOR THE X-RAY RADIOMETRIC ANALYSIS OF IRON ORES. Kozlov, O. V.; Mamikonyan, S. V.; Przhiyalgovsku, S. M.; Filatov, V. I.; Yakubovich, A. L. 1971. Translated from Radiats. Tekh.; No. 6, (1971).
In Radiation Technology, Issue 6.
The results of the experimental testing of the sources ^{3}H-Zr, ^{109}Cd, /sup 119m/Sn, and ^{241}Am in the analysis of powdered samples of iron ores are given. (LK)

14256 (MLM-2286) NUCLEAR SAFEGUARDS PROGRESS REPORT, July 1974-June 1975. Ratay, R. P. (ed.). (Mound Lab., Miamisburg, Ohio (USA)). 19 Dec 1975. Contract E-33-1-GEN-53. 25p. Dep. NTIS $4.00.
A nondestructive technique for the determination of the atomic ratios of plutonium-238, -240, -241 and americium-241 relative to plutonium-239 using high-resolution gamma-ray spectroscopy was developed. Results are discussed as they apply to various compositions of plutonium-239 material, some of which have been subjected to chemical analysis. Progress to date on an automated plutonium assay system is described. This system utilizes calorimetry and high-resolution gamma-ray spectroscopy. It also features a computer controlled X, Y, Z sample-handling system as well as automated data acquisition and reduction. (auth)

14257 (NRCN-TN-368) COMPARISON BETWEEN CALCULATED AND EXPERIMENTALLY DETERMINED SELF-ABSORPTION CORRECTIONS FOR LOW ACTIVITY β EMITTERS. Carmon, B. (Israel Atomic Energy Commission, Beersheba. Nuclear Research Center-Negev). Jan 1975. 18p. INIS. 13 refs., 3 tables.
Some of the most common long-lived fission products can be routinely assayed at activities below 1 pCi with an overall standard error of ±10% at a 95% confidence limit. The self-absorption correction factors from experimental curves are intercompared with theoretical values. The reliability of those calculated factors is discussed. (auth)

14258 CONTAMINATION PROBLEMS AND THE MEASUREMENT OF LOW-LEVEL POLONIUM-210. Langford, J. C.; Brodzinski, R. L. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Radiochim. Acta; 21: No. 1, 117-118(1974).
A procedure is described for the measurement of low-level ^{210}Po in which the detection limit is approximately 3×10^{-3} dpm. Reagents and apparatus have been investigated for ^{210}Po contamination, and the absolute contributions from these are reported. (DE)

14259 HIGH-SENSITIVITY RADIOASSAY BY GAS CHROMATOGRAPHY. Karmen, A.; Longo, N. S. (Yeshiva Univ., New York). J. Chromatogr.; 112: 637-642(29 Oct 1975).
From 10th international symposium on advances in chromatography; Munich, Ger. (3 Nov 1975).
An approach to radioassay of gas-liquid chromatographic effluents is described in which the sensitivity is increased by expanding the time available for the radioassay. Radioactive compounds in the effluent of the column are burned over heated copper oxide to $^{14}CO_2$ and $^{3}H_2O$. The effluent of the combustion tube is then passed through a scrubber consisting of a small-bore simulated gas chromatographic column that is simultaneously supplied with a small continuous flow of aqueous sodium hydroxide. The liquid effluent of the scrubber is pumped, segmented with air bubbles, into a long length of tubing for storage. The contents of this tube are subsequently pumped through a flow-through scintillation detector at a rate determined by the quantity of radioactivity present. (NL)

Separation Procedures

Refer also to abstract 15254.

14260 (AD/A-006275) SILICON-32 FIBER SAMPLER. Niskin, S. (Miami Univ., Fla. (USA). Rosenstiel School of Marine and Atmospheric Sciences). Feb 1975. Contract N00014-67-A-0201-0013. 8p. (UM-RSMAS-75009). NTIS $3.25.
To facilitate the extraction of cosmogenic Silicon-32 from sea water, a compliant bag-type sampler has been designed that eliminates excessive wire and sampler strain by connection to the lowering wire via a long, elastic nylon rope. Filtration takes place through a funnel-like mouth held open by water force while the sampler is hauled up or down. This silicon-32 sampler was employed serially during the GEOSECS expeditions. (GRA)

14261 (CEA-Bib-218(2)) EXTRACTION OF In, Tl, Sn, As, AND Sb BY NONPHOSPHORUS COMPOUNDS. Auchapt, J. M.; Tostain, J. (CEA Centre de Marcoule, 30-Bagnols-sur-Ceze (France); CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Service de Documentation). Dec 1975. 118p. (In French). Dep. NTIS (US Sales Only) $5.50.
The extraction of In, Tl, Sn, Sb, and As by methods that make use of nonphosphorus solvents are reviewed. Methods in which O-containing, N-containing, and hydrocarbon solvents are used are considered. The information complements that in a previously published report on extraction of the main elements contained in Zn ores. (JGB)

14262 (CEA-R-4702) INFLUENCE OF CARBOXYLIC ACIDS ADDITION ON THE ACTINIDES EXTRACTION BY TRILAURYLAMMONIUM NITRATE. Madic, C. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Div. de Chimie). Dec 1975. 256p. (In French). Dep. NTIS (US Sales Only) $9.00.
Thesis. Submitted to Paris Univ.
The extraction of actinides at III, IV, and VI oxidation states is considerably modified by the addition of carboxylic acids to trilaurylammonium nitrate solutions. An inhibition phenomenon is observed for strong acidities, however an opposite effect is developed at low acidities. The inhibition phenomenon is interpreted by the formation in organic phase of addition compounds like $R_3NHNO_3(HA)n$. The exaltation phenomenon interpreting has entailed a previous study of the extractive properties of carboxylic acids towards actinides at III, IV, and VI oxidation states and a study of the composition of the organic phase which has been realized by various methods: nitric acid displaced from organic solutions measurements; enthalpimetric titrations; dielectrometry. These studies let us come to the conclusion that the exaltation phenomenon of U(VI) extraction is due to the formation in organic solution of trilaurylammonium carboxylates which behave as cation exchangers. The negative synergisms displayed have been used to improve the purification process of irradiated ^{237}Np and to perform actinides reextraction initially present in organic solutions of trilaurylammonium nitrate. (auth)

14263 SORPTION OF THE MOLYBDENUM(VI) AND URANIUM (VI) IONS BY TITANIUM(IV) HYDROXIDE FROM SEAWATER. Barannik, V. P.; Zhorov, V. A.; Bezborodov, A. A.; Kobylyanskaya, A. G.; Abakumova, T. M. (Moscow Hydrophysics Inst.). Dopov. Akad. Nauk Ukr. RSR, Ser. B; No. 9, 771-774(Sep 1975). (In Ukrainian).
The paper deals with coprecipitation of uranium and molybdenum microquantities on titanium hydroxide from sea water. Uranium is shown to be sorbed more efficiently than molybdenum. The sorption magnitude is influenced by the capillary active substances. The complete recovery of uranium and molybdenum from sea water requires 2.2 mg/l of titanium. (auth)

14264 DIRECT DETERMINATION OF THE RATE CONSTANTS FOR THE Sr- AND Ba-EXCHANGE BETWEEN THE SMALL AND LARGE CHANNELS IN LMS 13X. Frohnecke, K.; Fischbach, H. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (F. R. German). Bereich Kernchemie und Reaktor). Z. Naturforsch., 30: No. 8, 951-954(Aug 1975). (In German)
6 figs.; 1 tab.; 9 refs.
The rate constants for the intracrystalline Sr and Ba exchange between the small and large diameter channels of LMS 13X were measured. For this matter the method of interrupting the ion exchange was modified. It is assumed, that a first order reaction takes place. Using the rate constants and the diffusion coefficients, which were measured by Hoinkis and Levi, the total exchange of Sr^{2+} could be calculated. (DE)

14265 SEPARATION OF RADIOACTIVE ATOMS. Gerstner, E.; Butenuth, J. (Marburg Univ. (F. R. Germany). Fachbereich Chemie). Chem. Unserer Zeit; 9: No. 4, 124-126(Aug 1975). (In German)
2 figs.; 4 refs.
By $PbSO_4$ precipitation and ether extraction from a uranium compound, the daughter products of the uranium decay could be separated to a large extent. The efficiency of both processes can be semi-quantitatively checked by means of a photographic plate (degree of density). (DE)

14266 SELECTIVE SEPARATION OF TECHNETIUM. Zuber, G.; Lieser, K. H. (Technische Univ. Darmstadt (F. R. Germany). Fachbereich Anorganische Chemie und Kernchemie). Radiochim. Acta; 21: No. 1, 60-62(1974). (In German).
2 figs.; 1 tab.; 8 refs.

Technetium can be separated on sparingly soluble sulfides from fission product solutions. The most efficient was cadmium sulfide. In separation columns from nitric acid solutions about 99% of the technetium was obtained containing small amounts of other fission products. Extraction with tetraphenylarsonium chloride in chloroform was used for purification. (DE)

14267 SELECTIVE SEPARATION OF CESIUM. Boeckl, R.; Lieser, K. H. (Technische Univ. Darmstadt (F. R. Germany). Fachbereich Anorganische Chemie und Kernchemie). Radiochim. Acta; 21: No. 1, 57-59(1974). (In German).

3 tabs.; 4 refs.

Cerium-137 and cesium-134 are separated from fission product solutions by means of columns filled with titanium hexacyanoferrate. By treating the columns with ammonia the cesium is obtained with yields > 99% in radiochemically pure form. Using an anion exchange resin it may be transformed into CsOH. (DE)

Inorganic, Organic, and Physical Chemistry

Refer also to abstracts 14300, 14765, and 14773.

Chemical and Physicochemical Properties

Refer also to abstracts 14332, 14340, 14349, 14764, 15174, 15349, 15350, 15623, 15813, 16263, and 16459.

14268 (AEC-tr-7295, pp 159-164) PRESENT STATE OF EXPERIMENTAL INVESTIGATION OF THERMOPHYSICAL PROPERTIES OF CHEMICALLY REACTING SYSTEMS N_2O_4, Al_2Br_6, AND Al_2Cl_6. Nesterenko, V. B.; Timofeev, B. D. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli I Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

Physical and chemical properties, including ranges of dissociation, are tabulated. Work on the thermophysical properties of the three gases are reviewed. 1 table, 34 references. (DLC)

14269 (AEC-tr-7295, pp 172-175) EFFECT OF IMPERFECTNESS OF THERMODYNAMIC PROPERTIES OF CHEMICALLY REACTING MIXTURES. Kessel'man, P. M.; Blank, Yu. I. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli I Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

Deviations from ideality of reacting mixtures are chiefly due to the reality of the pure components. Corrections for compressibility and enthalpy are considered for steam. It is shown that even at very high temperatures, it is generally necessary to consider the real-gas effects, both thermal and calorimetric. (DLC)

14270 (AEC-tr-7295, pp 176-182) CALCULATION OF THE "FROZEN" COMPONENT OF EFFECTIVE COEFFICIENT OF THERMAL CONDUCTIVITY OF DENSE, CHEMICALLY REACTING GASES. Kotelevskii, Yu. G.; Sviridova, V. D. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli I Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

The effective coefficient is the sum of two components: lambda /sub eff/ equals lambda/sub f/ + lambda/sub r ,/ where lambda /sub r/ is the contribution from the chemical reaction heat, and lambda/sub f/ is the "frozen" component or the normal molecular thermal conductivity of the nonreacting mixture. Calculations were made for the systems C_2H_4–CO_2, N_2–C_2H_4, and air deviations from experiment noted. Results show that general correlations for pure gases can be used to calculate the "frozen" component. (DLC)

14271 (AEC-tr-7295, pp 183-187) FORMS OF GASEOUS OXIDES. Dobrotin, R. B.; Rat'kovskii, I. A. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli I Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

This paper studies the conditions determining formation of mononuclear and multinuclear oxides in the gaseous phase. The difference between energies of single and double bonds is considered to determine the formation of multinuclear oxides, and data for this are tabulated and plotted for elements in the periodic table. (DLC)

14272 (AEC-tr-7295, pp 188-195) EXPERIMENTAL STUDY OF p-v-T RELATIONSHIP FOR DISSOCIATING NITROGEN TETROXIDE OVER A WIDE RANGE OF TEMPERATURES AND PRESSURES. Verzhinskaya, A. B.; Khasanshin, T. S. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli I Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

For the study of the p-v-T relation for N_2O_4 at 100 to 600°C and pressures up to 300 bar, a constant-volume ballastless piezometer with "hot" valve and "hot" membrane differential manometer was used. Experimental density values are tabulated. (DLC)

14273 (JUL-Conf-13) INTERNATIONAL SYMPOSIUM ON GENERATION AND AMPLIFICATION OF ASYMMETRY IN CHEMICAL SYSTEMS, JUELICH, 24–26 SEPTEMBER 1973. Thiemann, W. (ed.). (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany)). Nov 1974. 540p. (CONF-7309141-).

From international symposium on generation and amplification of asymmetry in chemical systems; Juelich, F. R. Germany (24 Sep 1973).

Twenty-two items were abstracted separately. Six were announced in Nuclear Science Abstracts and sixteen were announced in ERDA Research Abstracts. (LF)

For abstracts of individual papers see: 14274, 14275, 15622, 15623, 15812, and 15813.

14274 (JUL-Conf-13, pp 16-42) HISTORY OF THE INDUCTION OF MOLECULAR ASYMMETRY BY THE INTRINSIC ASYMMETRY IN β-DECAY. Vester, F. (Studiengruppe fuer Biologie und Umwelt, Muenchen, Ger.). Nov 1974.

From international symposium on generation and amplification of asymmetry in chemical systems; Julich, F. R. Germany (24 Sep 1973).

In international symposium on generation and amplification of asymmetry in chemical systems. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany)).

A historical survey is given of research on the relation between the intrinsic asymmetry of the physical universe and the asymmetric handedness of biosystems. Early experiments and their failings are presented. The significance of circular polarization of the bremsstrahlung of beta-decay electrons for the story is pointed out. It is suggested that ages of asymmetric irradiation of organic molecules led to the formation of helical macromolecules in the L configuration, molecules capable of sustaining life. The report is presented from the psychological and private side, and contains a psychology of doing research. (RWR)

14275 (JUL-Conf-13, pp 61-89) EXPERIMENTS ON THE ORIGIN OF MOLECULAR CHIRALITY BY PARITY NONCONSERVATION DURING β-DECAY. Bonner, W. A. (Stanford Univ., CA). Nov 1974.

From international symposium on generation and amplification of asymmetry in chemical systems; Julich, F. R. Germany (24 Sep 1973).

In international symposium on generation and amplification of asymmetry in chemical systems. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany)).

Experiments are described to test a theory for the origin of optical activity wherein the longitudinally polarized electrons resulting from parity violation during radioactive β decay, and

their resulting circularly polarized bremsstrahlung, might interact asymmetrically with organic matter to yield optically active products. The historical background to this subject is briefly reviewed. Experiments involved subjecting a number of racemic and optically active amino acid samples to irradiation in a 61700-Ci $^{90}Sr-^{90}Y$ β-radiation source for a period of 1.34 years (total dose: 4.11×10^8 rads), then examining them for any asymmetric effects by means of optical rotatory dispersion and analytical gas chromatography. In the cases of D,L-leucine, norleucine, norvaline and proline as solids, of D, L-leucine in solution (neutral and as Na and HCl salts) and of D, L-tyrosine in alkaline solution, no optical rotation was observed during ORD measurements in the 250–630 nm spectral region. While slight differences were noted in the percent radiolysis of solid D- (12.7%) and L-leucine (16.2%) as determined by GC, no enrichment of either enantiomer was found by GC analyses of irradiated D, L-leucine, either as a solid (13.7% radiolyzed) or as its Na salt (48.6% radiolyzed) or HCl salt (34.6% radiolyzed) in aqueous solution. Several explanations are offered for the experimental findings. (auth)

14276 DITHIOLATO COMPLEXES OF MOLYBDENUM AND TUNGSTEN. Nieuwpoort, A. Nijmegen, Netherlands; Katholieke Universiteit (1975). 154p.

Thesis.

The synthesis of eight-coordinated and six-coordinated tungsten and molybdenum complexes with dithioligands is described. Molecular and crystal structures are determined and bond angles, bond lengths and structural parameters tabulated. Infrared spectra of dithiocarbamato complexes are discussed more extensively. Redox reactions are studied by voltammetry and electron transfer properties derived. Properties of the d electrons of the metal ion are interpreted in the ligand field model with data from electronic and e.s.r. spectra and magnetic susceptibilities. The results of molecular orbital calculations with the extended Hueckel-LCAO method are presented for eight-coordinated d_1 and d_2 systems, the six-coordinated complexes, and the free ligands. (NL)

Isotope Effects

Refer also to abstracts 14328, 15620, 15660, and 15667.

14277 KINETIC ISOTOPE EFFECTS AND TUNNELLING IN THE PROTON-TRANSFER REACTION BETWEEN 4-NITROPHENYLNITROMETHANE AND TETRAMETHYLQUANIDINE IN VARIOUS APROTIC SOLVENTS. Caldin, E. F.; Mateo, S. (Kent Univ., Canterbury, Eng.). J. Chem. Soc. (London), Faraday Trans., I; 71: No. 9, 1876-1904(1975).

Rates and equilibrium constants have been determined for the proton-transfer reaction of 4-nitrophenylnitromethane, $NO_2C_6H_4CH_2NO_2$, and its $\alpha\alpha$-deuterated analog $NO_2C_6H_4CD_2NO_2$, with the strong base tetramethylguanidine [$HN = C(NMe_2)_2$], at temperatures between −60°C and +65°C in the range of aprotic solvents. Spectrophotometry and the stopped-flow technique were used. The reaction is a simple proton-transfer process leading to an ion-pair. The kinetic isotope effects are correlated with the polarity of the solvents, as measured by the dielectric constant or by the empirical parameter E_T. In the less polar solvents they are exceptionally large. In toluene, for example, at 25°C the rate ratio $k^H/k^D = 45 \pm 2$, the activation energy difference $E_a^D - E_a^H = 4.3 \pm 0.3$ kcal mol^{-1} (16 kJ mol^{-1}), and the ratio of the pre-exponential factors $\log_{10}(A^D/A^H) = 1.5 \pm 0.2$; and even larger values of $\log_{10}(A^D/A^H)$ are found for mesitylene (1.94 ± 0.06) and cyclohexane (2.4 ± 0.2). Positive deviations from linear Arrhenius plots are found for these solvents. Tunnelling is the only interpretation that can account for these results. For the more polar solvents (dielectric constant 7 to 37), the isotope effects are claser to the range predicted by semi-classical theory. The isotope effects in all solvents have been fitted to Bell's equation for a parabolic barrier, and the barrier dimensions calculated for each solvent. The suggested interpretation of the results is that the solvent-solute interactions affect the height of the barrier and that motions of solvent molecules are coupled with the motion of the proton in the more polar solvents but not in the less polar ones; reorganization of solvent molecules accompanies the proton-transfer in the more polar solvents, but only electron-polarization in the less polar. Tunnelling has large effects in the less polar solvents, where the proton is the only atom that moves in the rate-determining step, but much smaller effects in the more polar solvents where solvent motion is coupled to that of the proton. Other reactions showing tunnelling effects are considered in the light of this conclusion. (auth)

14278 ANOMALOUS PROPERTIES OF THE NONINTRINSIC FERROELECTRIC CRYSTAL $RbH_3(SeO_3)_2$ AND THE ISOTOPIC EFFECT. Shuvalov, L. A.; Ivanov, N. R.; Shirokov, A. M.; Boiko, A. A.; Kirpichnikova, L. F.; Gordeeva, N. V.; Baranov, A. I.; Fouskova, A.; Ryabkin, V. S.; Babayants, V. A.; Aknazarov, S. Kh. (Crystallography Inst., Moscow). Sov. Phys.-Crystallogr. (Engl. Transl.); 20: No. 2, 206-211(1975).

Translated from Kristallografiya; 20: No. 2, 336-346(1975).

Currently known experimental data on the anomalies of the physical properties of the nonintrinsic ferroelectric crystal $RbH_3(SeO_3)_2$ which accompany a phase transition are summarized. The temperature dependences of the permittivitiy, spontaneous polarization, elastic compliance, thermal expansion, and specific heat are studied, as well as the temperature dependence of the phase-transition shear under pressure. The similarities and differences in the behavior of $RbH_3(SeO_3)_2$ and $RbD_3(SeO_3)_2$ are discussed. (auth)

14279 INVERSION AND TUNNELING IN AZIRIDINE AND AZIRIDINE-N-d. Gas-Phase Nuclear Magnetic Resonance Band Shape Analysis and Model Calculations of the Isotope Effect. Carter, R. E.; Drakenberg, T.; Bergmen, N. A. (Univ. of Goetborg). J. Am. Chem. Soc.; 97: No. 24, 6990-6996(26 Nov 1975).

The inversion barriers in aziridine and aziridine-N-d were measured in the gas phase by NMR total band shape analysis. The isotope effect on the inversion barrier may be described by the following parameters (at 65°C): DELTA DELTA $G^{2\dagger}$(equals DELTA $G^{2\dagger}$/sub D/ - DELTA $G^{2\dagger}$/sub H/) equals 0.57 +- 0.07 kcal/mol, DELTA DELTA $H^{2\dagger}$ equals 2.1 +- 1.2 kcal/mol, DELTA DELTA $S^{2\dagger}$ equals 4.8 +- 3.6 cal/(mol K), and k/sub H//k/sub D/ equals 2.34. Model calculations of the isotope effect, including complete vibrational analyses of the two isotopic species, are able to reproduce the experimental data only if tunneling is taken into account. Reaction coordinate frequencies of parallel $nu^{2\dagger}$/sub H/ parallel equals 1050 +- 50 cm^{-1} and parallel $nu^{2\dagger}$/sub D/ parallel equals 800 +- 40 cm^{-1} for the protium and deuterium compounds, respectively, were estimated, and the barrier height, corrected for zero-point energy differences between initial and transition states (and thus comparable with theoretical inversion barriers obtained by molecular orbital methods), was found to be 19.1 kcal/mol. (auth)

14280 CHEMICAL SYNTHESIS USING METAL ATOMS. Matrix Infrared, Raman, Ultraviolet-Visible, and Electron Spin Resonance Studies of the Binary Carbonyls of Cobalt, Co(CO)/sub n/ (where n equals 1-4), and the Distortion Problem in $Co(CO)_4$. Hanlan, L. A.; Huber, H.; Kuendig, E. P.; McGarvey, B. R.; Ozin, G. A. (Univ. of Toronto). J. Am. Chem. Soc.; 97: No. 24, 7054-7068(26 Nov 1975).

The cocondensation reactions of Co atoms with CO at 6 to 15°K were investigated for the first time using matrix infrared, Raman, uv-visible, and ESR spectroscopy. Using extremely low Co concentrations (Co:M approximately equal to $1:10^4$ to $1:10^5$) which were found to favor the formation of mononuclear complexes, variable concentration $^{12}C^{16}O$–M experiments (where M equals Ne, Ar, Kr, or Xe), $^{12}C^{16}O$–$^{13}C^{16}O$ and $^{12}C^{16}O$–$^{12}C^{18}O$–M mixed isotopic substitution, in conjunction with matrix warm-up experiments, the reaction products were found to be Co(CO)/sub n/ (where n equals 1 to 4). The molecule has axial symmetry and S equals ½. The spin-Hamiltonian parameters are consistent with a C/sub 3v/ trigonal distortion. Striking confirmation of the C/sub 3v/ distortion is obtained from the ^{13}C hyperfine splitting of $Co(^{13}C^{16}O)_4$ in 93 percent $^{13}C^{16}O$. The corresponding uv-visible spectrum displays ligand field and charge transfer bands in the region 200-350 nm. The ESR data for $Co(CO)_4$ in Ar matrices provide evidence for two forms of the molecule, $Co(CO)_4$ (I) and $Co(CO)_4$ (II). (JGB)

14281 CHEMICAL EVOLUTION OF A NITROGENASE MODEL. X. Reduction of Coordinated Cyanide Ion in Cyano Complexes of Molybdenum(IV) and Their Use as Catalysts for the Reduction of Molecular Nitrogen and of Other Substrates. Schrauzer, G. M.; Robinson, P. R.; Moorehead, E. L.; Vickrey, T. M. (Univ. of California, San Diego). J. Am. Chem. Soc.; 97: No. 24, 7069-7076(26 Nov 1975).

The complex anions $[Mo(O)_2(CN)_4]^{4-}$ (1), $[Mo(O)(OH)(CN)_4]^{3-}$ (2), and $[Mo(O)(H_2O)(CN)_4]^{2-}$ (3) represent rare examples of defined monomeric complexes of oxomolybdate(IV) and may be regarded as models of substrate-catalyst complexes in the reduction of CN^- by molybdothiol catalyst systems. The reduction of coordinated CN^- in 3 to NH_3, CH_4, C_2H_6, and C_2H_4 was demonstrated with BH_4^-, $S_2O_4^{2-}$, and reduced ferredoxin model compounds as reducing agents. Evidence for a significant stimulatory effect of adenosine triphosphate (ATP) was also obtained. The reduction of coordinated CN^- is inhibited by O_2, CO, and the known substrates of nitrogenase enzymes. The latter are reduced under the reaction conditions, involving coordinatively unsaturated cyano complexes of oxomolybdate(IV) as the catalysts. The reduction of molecular N_2 to NH_3 and traces of N_2H_4 was also observed and proceeds more efficiently than in the molybdothiol model systems of nitrogenase. ATP causes a significant stimulation of CN^- reduction in H_2O, but not in D_2O. (auth)

14282 CARBON ISOTOPE EFFECTS ON PROTON TRANSFERS FROM CARBON, AND THE QUESTION OF HYDROGEN TUNNELING. Yeagle, P. L.; Hutton, W. C.; Martin, R. B. (Univ. of Virginia, Charlottesville). J. Am. Chem. Soc.; 97: No. 24, 7177-7178(26 Nov 1975).

A study of beta-carbon-13 isotope effects on reactions of 2-phenylethyldimethylsulfonium and -trimethylammonium ions with hydroxide ion in mixtures of water and dimethyl sulfoxide was made. Both reactions show maxima in k/sub H//k/sub D/ as the percentage of dimethyl sulfoxide is varied. The resulting isotope effects, expressed as the percentage by which k_{12}/k_{13} exceeds unity, are compared with previously reported k/sub H//k/sub D/ values. Evidence is reported that the tunnel effect makes an important contribution to hydrogen isotope effects in proton transfers but does not control the form of the dependence of the isotope effect on the strength of the attacking base. (JGB)

14283 BIFUNCTIONAL CATALYSIS OF THE ENOLIZATION OF ACETONE. Hegarty, A. F.; Jencks, W. P. (Brandeis Univ., Waltham, MA). J. Am. Chem. Soc.; 97: No. 24, 7188-7189(26 Nov 1975).

The third-order term for acid–base catalysis of acetone enolization was found to exhibit a Bronsted beta/sub AB/ value of 0.15, a solvent isotope effect of k/sub H_2O//k/D_2O/ equals 2.0, and a C–H isotope effect of k/sub H//k/sub D/ equals 5.8. It is concluded that this reaction represents true bifunctional catalysis with partial proton abstraction by acetate ion and a significant movement of the proton of acetic acid toward the carbonyl oxygen atom in the transition state. (JGB)

14284 SOLVENT DEPENDENCE OF THE PRIMARY DEUTERIUM KINETIC ISOTOPE EFFECT IN THE SODIUM HYDROXIDE-CATALYZED E2 ELIMINATION OF HYDROGEN BROMIDE FROM p-ACETYL- AND p-NITRO-PHENETHYL BROMIDE. Blackwell, L. F.; Woodhead, J. L. (Massey Univ., Palmerston North, N. Zealand). J. Chem. Soc. (London), Perkin Trans., II; No. 11, 1218-1220(1975).

Rate constants have been determined from the NaOH-catalyzed 1,2-elimination of HBr from p-acetyl- and p-nitro-phenethyl bromide over a range of dimethyl sulphoxide concentrations. The calculated k_2^H/k_2^D ratios show no dependence on the para-substituent or the dimethyl sulphoxide concentration except for p-nitrophenethyl bromide at 59.7 and 69.7 mole %. The change in the isotope effect for the p-nitro-compound cannot be satisfactorily explained in terms of a change in transition-state symmetry. The previously reported substituent-induced maximum in the isotope effect for phenethyl bromides is shown to be due to a specific solvent effect rather than indicative of a "Westheimer" maximum. The implication of the overall lack of variation is briefly discussed. (auth)

14285 POTENTIAL BARRIER TO INTERNAL ROTATION IN METHYL FLUOROFORM. Durig, J.R.; Bucy, W.E.; Wurrey, C.J. (Department of Chemistry, University of South Carolina, Columbia, South Carolina 29208). J. Chem. Phys. 63: No. 12, 5498-5499 (15 Dec 1975).

The Raman and microwave spectra of CF_3CD_3 are reported and used to obtain a more accurate determination of the potential barrier to internal rotation. The microwave results give a barrier of 3.2±0.2 kcal/mole, however, this is not in accord with the trends for chlorine or bromine substituted ethanes. (AIP)

14286 POTENTIAL CONSTANTS OF $K_2Zn(CN)_4$ IN THE CRYSTAL LATTICE. Jones, L.H. (University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545); Swanson, B.I. J. Chem. Phys. 63: No. 12, 5401-5410 (15 Dec 1975).

The vibrational spectra of the crystalline materials $K_2Zn(CN)_4$, $K_2Zn(^{13}CN)_4$, $K_2Zn(C\,^{15}N)_4$, $K_2\,^{64}Zn(CN)_4$, and $K_2\,^{68}Zn(CN)_4$ have been observed using infrared and Raman spectroscopy. A number of the potential constants in this system have been calculated from the various isotopic frequencies. It was necessary to constrain several of the potential constants which are essentially indeterminate. An analysis of these constraints was made to show that they are justified. A comparison of the potential constants of $Zn(CN)^{-2}_4$ with isoelectronic $Ni(CO)_4$ shows that for the zinc complex there is negligible back-π bonding of the zinc *d* orbitals to the CN ligands. A number of interesting stretch-stretch and stretch-bend interactions are discussed. (auth)

14287 THE STIMULATED RAMAN SPECTRUM OF WATER AND ITS RELATIONSHIP TO LIQUID STRUCTURE. Sceats, M.; Rice, S.A.; Butler, J.E. (The Department of Chemistry and The James Franck Institute, The University of Chicago, Chicago, Illinois 60637). J. Chem. Phys. 63: No. 12, 5390-5400 (15 Dec 1975).

Stimulated Raman spectra (SRS) of H_2O, D_2O, H_2O–D_2O mixtures, and aqueous solutions of $NaClO_4$ have been measured using a mode-locked, stabilized Nd glass laser operating in the TEM_{00} mode. Spectra with relatively narrow peaks were obtained in all cases, as predicted by the first order theory of SRS. Other effects (such as multiple peaks, broadened spectra, and shifted peaks), which have been interpreted as evidence for a mixture model of water, are reconsidered, and it is argued that they are either artifacts arising from modulation by stimulation in the hydrogen bond bending region or arise from disruption of thermal equilibrium in filaments due to the high electric fields present in the focused laser beam. (auth)

14288 INTERNAL ROTATION IN ETHYLAMINE: A TREATMENT AS A TWO-TOP PROBLEM. Tsuboi, M.; Tamagake, K.; Hirakawa, A.Y.; Yamaguchi, J.; Nakagawa, H. (Faculty of Pharmaceutical Sciences, University of Tokyo, Hongo, Bunkyo-ku, Tokyo, Japan); Manocha, A.S.; Tuazon, E.C.; Fateley, W.G. J. Chem. Phys. 63: No. 12, 5177-5189 (15 Dec 1975).

The infrared absorption spectra of eight isotopic ethylamine molecules, i.e., $CH_3CH_2NH_2$, $CD_3CH_2NH_2$, $CH_3CD_2NH_2$, $CD_3CD_2NH_2$, $CH_3CH_2ND_2$, $CD_3CH_2ND_2$, $CH_3CD_2ND_2$, and $CD_3CD_2ND_2$, have been examined in the vapor phase in the 300–100 cm^{-1} region. Several *Q*-branch peaks were observed for each isotopic species and assigned to the torsional oscillations of the methyl and amino groups of the *trans* and *gauche* isomers. The energy levels were calculated on the basis of a coupled two top system. The analysis yielded a probable potential function for the internal rotation about the C–N bond of the form $V(\alpha) = (316.5/2)(1-\cos\alpha)-(11.3/2)(1-\cos2\alpha)+(713.7/2)(1-\cos3\alpha)-(25.0/2)(1-\cos4\alpha)+(25.0/2)(1-\cos5\alpha)-(3.7/2)(1-\cos6\alpha)$. The difference between the potential energy minima of the *trans* and *gauche* conformations is about 230 cm^{-1}, the *trans* being the more stable form. It has been concluded that the axis of internal rotation of the amino group does not coincide with the N–C bond but is along a line about 4.5° from the N–C bond and in the plane bisecting the NHH triangle. (auth)

14289 THE EFFECT OF PRESSURE ON THE NEAR-NEIGHBOR DISTANCE IN WATER. Whalley, E. (Division of Chemistry, National Research Council, Ottawa K1A 0R9, Canada). J. Chem. Phys. 63: No. 12, 5205-5207 (15 Dec 1975).

When liquid water is compressed, the O- -O hydrogen bonds tend to contract because of the direct effect of the pressure, and the O- -O- -O angles tend to deviate more from the tetrahedral. The coupling between the O- -O stretching and O- -O- -O angle bending is such that the change of the angles tends to increase the bond lengths. The net effect of pressure is the resultant of the direct contraction and the indirect expansion. It is suggested that the actual contraction can be measured by the effect of pressure on the O–H or O–D stretching frequencies of HDO in dilute solution in D_2O or H_2O. The application of this suggestion to literature data shows that the bond contracts only about 0.3 of the rate that the hydrogen bond in ice contracts. No doubt the contraction due to the direct effect of pressure is largely compensated by the expansion due to the distortion of the O- -O- -O angles. (auth)

14290 VIBRATIONAL SPECTRA AND TORSIONAL BARRIER OF CYCLOPENTADIENYL BERYLLIUM BOROHYDRIDE, $C_5H_5BeBH_4$. Coe, D.A.; Nibler, J.W.; Cook, T.H. (Department of Chemistry, Oregon State University, Corvallis, Oregon 97331); Drew, D.; Morgan, G.L. J. Chem. Phys. 63: No. 11, 4842-4853 (1 Dec 1975).

Infrared and Raman spectra are reported for liquid and solid C_5H_5BeCl, $C_5H_5BeBH_4$, and $C_5H_5BeBD_4$ and vibrational assignments of most of the C_5H_5, BeX, and skeletal modes are made. Conclusive evidence for a double hydrogen bridge configuration is found for $C_5H_5BeBH_4$ and, in contrast to $Be(BH_4)_2$, this structure is unchanged in going from gas to liquid to solid. The C_5H_5 frequencies are in close accord with those of $(C_5H_5)_2Fe$ while the vibrations of the $BeBH_4$ group are analogous to those reported earlier for the $^+BeBH_4$ ion in solid $Be(BH_4)_2$. Observation of several transitions for the skeletal torsional motion of $C_5H_5BeBH_4$ implies that free internal rotation about the symmetry axis does not occur and calculations yield a value of 500 cm^{-1} for the tenfold torsional barrier. Raman polarization data are consistent with a low energy orientation which places the BeH_2B bridging plane and a C_s molecular symmetry plane in coincidence. (auth)

Isotope Exchange and Isotope Separation

14291 REACTIVITY OF BINUCLEAR COMPLEXES OF TRANSITION METALS. Hydrogen–Deuterium Exchange Between Cymantrenylferrocene and Acids. Nesmeyanov, A. N.; Kursanov, D. N.; Setkina, N. V.; Sazonova, V. A.; Fedin, E. I.; Petrovskii, P. V.; Sedova, N. N.; Volgin, Yu. V. (Inst. of Heteroorganic Compounds, Moscow). Dokl. Chem.; 221: No. 4-6, 242-245(Apr 1975).

Translated from Dokl. Akad. Nauk SSSR; 221: No. 4, 854-857 (Apr 1975).

A systematic study was made of the extent to which the reactivity of the ferrocenyl group in cymantrenylferrocene is changed by the presence of the symantrenyl substituent and the relative

reactivities of the nonequivalent positions in this system were characterized by a study of the hydrogen-deuterium exchange with acids. The deuterium exchange data and its distribution and partial rate factors for different positions were determined and the data were tabulated. (JSR)

14292 ISOTOPIC AND NONISOTOPIC THERMAL DIFFUSION FACTORS FROM COLUMN MEASUREMENTS. Savirón, J.M.; Santamaría, C.M.; Carrión, J.A.; Yarza, J.C. (Departamento de Física Fundamental, Facultad de Ciencias, Universidad de Zaragoza, Spain). J. Chem. Phys. 63: No. 12, 5318-5321 (15 Dec 1975).

Experimental steady state separation data obtained in a concentric tube type Clusius–Dickel column for seven He–Ar mixtures, five Ne–Xe mixtures, and the isotopic natural Ne mixture at $\bar{T}=340\pm5$ K are presented. The results show that thermogravitational columns are able to furnish correct values for the thermal diffusion factors of the mixtures examined when any one of them is used as a calibration mixture. (auth)

Feed Materials Processing

Refer also to abstracts 14817 and 14820.

14293 (AAEC/E-356) BACTERIAL LEACHING OF URANIUM ORES: A REVIEW. Lowson, R. T. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Nov 1975. 52p. Dep. NTIS (US Sales Only) $4.50.

The bacterial leaching of uranium ores involves the bacterially catalyzed oxidation of associated pyrite to sulfuric acid and Fe^{3+} by autotrophic bacteria and the leaching of the uranium by the resulting acidic, oxidizing solution. Industrial application has been limited to Thiobacillus thiooxidans and Thiobacillus ferrooxidans at pH 2 to 3; examples of these are described. The bacterial catalysis can be improved with nutrients or prevented with poisons. The kinetics of leaching are controlled by the bed depth, particle size, percolation rate, mineralogy, and temperature. Current work is aimed at quantitatively defining the parameters controlling the kinetics and extending the method to alkaline conditions with other autotrophic bacteria. (auth)

14294 (PB-238465) ECONOMIC SIGNIFICANCE OF THE FLORIDA PHOSPHATE INDUSTRY. Information Circular. Wang, K.; Klein, B. W.; Powell, A. F. (Bureau of Mines, Arlington, Va. (USA). Office of Economic Analysis Mineral Supply). Nov 1974. 5p. (BM-IC-8653). NTIS $3.10.

This Bureau of Mines study illustrates the economic significance of the Florida phosphate industry to the State and to the Nation. Environmental considerations related to phosphate industry activity are discussed briefly. Based on forecasts of Florida phosphate production in 1975, and using 1972 dollars, regional and national output value, income, and employment created by the phosphate industry, were estimated for 1975. State and federal government tax revenues generated by the phosphate industry are also measured. Further, the concentrated impact of the phosphate industry on certain Florida areas and industries is examined. Finally, the phosphate industry's importance to the U.S. balance of payments, U. S. agricultural production, and the Frasch sulfur industry is considered, in addition to byproduct fluorine, and potential byproduct uranium from fertilizer manufacturing. (GRA)

14295 (PB-238655) TRACE POLLUTANT EMISSIONS FROM THE PROCESSING OF METALLIC ORES. Environmental Protection Technology Series (Final). Katari, V.; Isaacs, G.; Devitt, T. W. (PEDCO-Environmental Specialists, Inc., Cincinnati, Ohio (USA)). Oct 1974. Contract EPA-68-02-1321. 282p. NTIS $8.75.

The report gives results of a study of eight metallic ore processing industries. Selected for their potential for hazardous pollutant emissions, the industries were: iron and steel, ferroalloy, primary copper, primary lead, primary zinc, aluminum, titanium, and uranium. Bases for selection were: quantity of ore processed, toxicity of potential emissions, fugitive dust emissions potential, and process characteristics. The report describes the processes in each industry in terms of a functional process statement, process operating conditions, energy requirements, potential emissions, and method of transferring material from one process to the next. Eleven processes are recommended for more detailed study because of their significant hazardous pollutant emissions potential. (GRA)

14296 PREPARATION OF AN AQUEOUS ACTINIDE METAL SALT SOLUTION SUBSTOICHIOMETRIC WITH RESPECT TO THE ACID IONS. (to Interfuel B. V.). Netherlands Patent 7,403,964/A/. 25 Mar 1974. 10p. (In Dutch)

By precipitating an aqueous solution of uranyl nitrate with ammonia at pH 3.6-7, preferably between 4.6 and 6.7, and at a temperature between 15 and 90°C, preferably between 50 and 70°C, an ammonium uranate is obtained which readily dissolves in an aqueous solution of an actinide metal such as plutonium nitrate. In this way an aqueous solution of one or more actinide metals is obtained in which the ratio of the anionic to the cationic modality is less than one. Such a solution is especially suitable for the sol-gel-process for preparing nuclear fuel pellets containing actinide metals. (NL)

Radiation Chemistry

Refer also to abstracts 14322–14324, 14329, 15019, 15028, 15337, 15347, 15348, and 15354.

14297 (AD/A-005066) EFFECT OF IONIZING RADIATION ON COMBUSTION OF AMMONIUM PERCHLORATE AND MIXTURE SYSTEMS OF THE LATTER. Strunin, V. A.; Manelis, G. B.; Ponomarev, A. N.; Talroze, V. L. (AN SSSR, Moscow. Fizicheskij Inst.). 4 Oct 1974. Trans. of Akademiya Nauk SSSR. Fizicheskii Institut. Preprint, p1-9, 1969. (FSTC-HT-23-860-74). 15p. NTIS $3.25.

Ammonium perchlorate and mixtures of it were studied for the effect of ionizing radiation. Various types of ionizing radiation showed the effect on the combustion of ammonium perchlorate of different pressures and temperatures. The results obtained agreed with the theories held on the role of processes taking place in the condensed zone and on determining the combustion rate. (GRA)

14298 (AEC-tr-7295, pp 216-223) COEFFICIENT OF HEAT TRANSFER IN A SLIT-SHAPED CHEMONUCLEAR CHANNEL. Kazazyan, V. T.; Roginets, L. P. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli I Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yaderno Ehnergetiki).

Factors to be considered in solving problems of heat transfer in the radiation element of a chemonuclear reactor include: variable thermophysical properties because of the change in composition of the reagent during nonisothermal flow in the radiation field along the height of the channel, radiation-chemical reactions, and energy liberation along the cross-section of the channel in the reagent, as well as the channel walls. (MCG)

14299 (AEC-tr-7533/10) NUKLEONIKA. Translation of Nukleonika; 19: No. 10, 851-948(1974). 86p. (TT-74-54003/10). Dep. NTIS $5.00.

14300 (BARC-786) CHEMISTRY DIVISION ANNUAL PROGRESS REPORT FOR 1974. (Bhabha Atomic Research Centre, Bombay (India)). 1974. 154p. Dep. NTIS (US Sales Only) $7.75.

Research progress in reactor-related programs, materials development, radiation chemistry, inorganic and physical chemistry, theoretical studies, and instrumentation is reported. A list of publications is included. (JGB)

14301 (BARC-787) ELECTROLYTIC GENERATION OF HYDRATED ELECTRON. Mazumdar, A. S. G.; Guha, S. N. (Bhabha Atomic Research Centre, Bombay (India). Chemistry Div.). 1975. 22p. Dep. NTIS (US Sales Only) $3.50.

Investigations on the electrolytic generation of hydrated electron in oxygenated as well as oxygen-free solutions at different pH were undertaken. Since e^-_{aq} is known to react rapidly with O_2 yielding the transient O_2^- ion, the latter was looked for through its interaction with phosphite ions resulting in their oxidation near the cathode. It appears from the results that in electrolytic processes, the primary electron ($e^-_{cathode}$) probably reacts directly with reactive solutes like oxygen, bypassing the hydration step. Data obtained in oxygen-free solutions, however, support the possible formation of hydrated electron at least in alkaline solutions. (auth)

14302 (FRNC-TH-529) CONTRIBUTION TO THE STUDY OF CARBOHYDRATE RADIOLYSIS: STUDY OF THE FORMATION OF MALONIC ALDEHYDE DURING GAMMA IRRADIATION OF GLUCOSE. Enrico, G. (Aix-Marseille-3 Univ., 13- Marseille (France)). 1974. 87p. (In French). INIS.

It was shown that malonic aldehyde can be formed directly by radiation of dry glucose or through the radicals of water when the latter is present. The direct effect leads to a malonic aldehyde production proportional to the dose and independent of dose rate, temperature over a wide range, presence of oxygen and crystalline state of the glucose, but strongly dependent on the water content

and anomeric form of the glucose. Isotopic labelling showed that both ends of the glucose molecule participate in the malonic aldehyde formation. Extrapolation to linear polymers (maltose, maltotriose) reveals the independence of the radiolysis yield with regard to the α 1–4 bond and suggests that it tends towards that of glucose in amylose. The indirect effect is linked with the action of the OH radicals of water and appears when glucose is irradiated in a sufficiently hydrated state or in solution. In the latter case the malonic aldehyde concentration is largely independent of the glucose concentration and is not proportional to the dose. Oxygen has little effect but a strong activation is observed at high pH. The use of ^{14}C showed that the aldehyde end of glucose is responsible for most of the malonic aldehyde. Polymerisation of the glucose by a α 1–4 binding reduces the radiolytic yield. The indirect effect would thus be negligible in amylose. (FR)

14303 (IRE-6/1974) LITERATURE STUDY OF THE POTENTIAL USE OF GAMMA RADIATION IN A WATER PURIFICATION INSTALLATION. Van Den Broeck, P.; Schietecatte, W. (Institut National de Radioelements, Brussels (Belgium)). Nov 1974. 22p. (In Dutch). Dep. NTIS (US Sales Only) $3.50.

The application possibilities of gamma radiation in a water purifying installation are being examined by means of data taken from reference works. The influence of gamma radiation on the removal of impurities, on the sanitation and sedimentation of sewage waters and sludge, on cost price and on practical appliances were considered. (auth)

14304 (RRL-3238-541(Q-73)) MELLON INSTITUTE OF SCIENCE, RADIATION RESEARCH LABORATORIES QUARTERLY REPORT, 1 JULY 1975–30 SEPTEMBER 1975. Mellon Inst. of Science, Pittsburgh (USA). Rdiation Research Labs. (USA)). 8 Oct 1975. 19p. Dep. NTIS $3.50.

Abstracts are given of reports issued during the quarter. Other current research programs are briefly summarized. (JSR)

14305 (RRL-3238-542) ANNUAL REPORT, OCTOBER 1, 1974–SEPTEMBER 30, 1975. (Mellon Inst. of Science, Pittsburgh (USA). Radiation Research Labs.). 10 Oct 1975. Contract AT(11-1)-3238. 31p. Dep. NTIS $4.00.

Research progress is reported in the following areas: steady-state radiolysis–ESR studies, optical pulse radiolysis studies, time-resolved ESR spectroscopy, and liquid chromatographic examination of radiation-produced products. Brief summaries of other studies, as well as a list of publications and oral presentations, are also included. (JGB)

14306 EFFECT OF HIGH TEMPERATURE X-RAY IRRADIATION ON THE THERMOLUMINESCENCE OF KCl CRYSTALS. Das, B. N. (Indian Inst. of Tech., Kharagpur). J. Mater. Sci.; 10: No. 9, 1643-1645(Sep 1975).

The purpose of this communication is to show that the complexity of the thermoluminescence of x-ray irradiated (at room temperature) KCl crystal can be reduced by increasing the irradiation temperature, and that even for the crystal irradiated at a higher temperature, the thermal bleaching of F-centers is responsible for the thermoluminescence. Experimental details are given, and results are discussed. (auth)

14307 APPLICABILITY OF THE DIFFUSION-RECOMBINATION MODEL TO LOW-TEMPERATURE RADIATION OF POLAR SOLID SOLUTIONS. Byakov, V. M.; Ershov, B. G. (Inst. of Physical Chemistry, Moscow). Dokl. Phys. Chem.; 222: No. 1-3, 507-509(May 1975).

Translated from Dokl. Akad. Nauk SSSR; 222: No. 3, 637-640 (May 1975).

The experimental dependence of the ion pair yield in the low-temperature radiolysis of solid solutions on the concentration of electron acceptors is analyzed by using the diffusion-recombination model. The results showed that this model is suitable for describing the low-temperature radiolysis of polar solid solution. The finding that the values of G_R (radical yield) and G_{-M} (initial yield of the decomposition of ionizing particles along the track) come close to those for solutions at room temperature proves that the primary processes proceeding in tracks at high and low temperatures are identical. (JSR)

14308 TRANSFORMATIONS INDUCED IN POWDERED SULFUR NICKEL MIXTURES IRRADIATED BY FAST ELECTRONS. Belin, E. (Paris-6 Univ., 75 (France)). J. Chim. Phys.; 72: No. 5, 595-600(May 1975). (In French)

Some powder samples of S-Ni mixtures have been irradiated by fast electrons up to a few tens of keV. Formation of sulfides has been observed. Study of the reaction rate with respect to irradiation conditions showed that the beginning of the reaction is connected with the ionizing action of the electron beam. The influence on the rate of propagation of secondary phenomena, following ionization, is discussed jointly with the importance of the diffusion of the elements. (FR)

14309 RADIATION SULFOXIDATION OF N-PARAFFINS. II. Kinetic Laws for the Formation of Persulfonic Acids of N-Paraffins During Sulfoxidation. Popov, A. I.; Mikhailov, G. G.; Zagorets, P. A.; Dzhagatspanyan, R. V.; Sobolev, I. A.; Kosorotov, V. I. High Energy Chem. (USSR) (Engl. Transl.); 9: No. 1, 35-38(1975).

Translated from Khim. Vys. Energ.; 9: No. 1, 46-50(1975).

The effect of dose rate on the stationary concentration and rate of formation of persulfonic acid during the sulfoxidation of n-paraffins was investigated. Expressions were obtained for these parameters and the absolute rate constant for the reaction $R^{\cdot} + SO_2 \rightarrow RSO_2^{\cdot}$ at 20° was determined. (auth)

14310 MECHANISM OF THE RADIOLYTIC OXIDATION OF HYDROCARBONS. Komarov, P. N. (Physical Chemistry Inst., Moscow). High Energy Chem. (USSR) (Engl. Transl.); 9: No. 1, 30-34(1975).

Translated from Khim. Vys. Energ.; 9: No. 1, 39-45(1975).

Consideration is given to possible mechanisms for the nonchain oxidation of organic compounds by molecular oxygen on exposure to ionizing radiation. It is shown to be a free radical process of oxidation, by oxygen, of atoms and radicals generated by the radiation. Using cyclohexane as an example, relationships are obtained which connect the composition and radiation-chemical yields of the oxidation products to the principal parameters of the process and which correlate satisfactorily with the available experimental results. (auth)

14311 MOBILITY AND RELAXATION TIME OF THE QUASI-FREE ELECTRON IN LIQUID HEXANE. Balakin, A. A.; Yakovlev, B. S. (Inst. of Chemical Physics, Moscow). High Energy Chem. (USSR) (Engl. Transl.); 9: No. 1, 22-25(1975).

Translated from Khim. Vys. Energ.; 9: No. 1, 29-33(1975).

From the results of an investigation, in the 10^{-7} sec region, of the rate of change of the electron conductivity induced by fast electrons in liquid hexane at 190°K an attempt has been made to separate out the component of the current connected with the conductivity of an electron in a quasi-free state. Since the value of this component turned out to be less than the error in the current measurements an estimate was made of the product $\mu'\tau' < 3 \cdot 10^{11}$ cm^2/V, where τ' is the residence time of an electron in a quasi-free state of mobility μ'. This estimate leads to a value for the mobility of a thermalized electron in the quasi-free state given by $\mu_0 < 200$ $cm^2/V \cdot sec$ and to a thermalization time $\tau < 2 \cdot 10^{-13}$ sec. (auth)

14312 KINETICS OF THE RADIATION–CHEMICAL OXIDATION OF PYRIDINE IN AQUEOUS SOLUTIONS. Kostromin, N. P.; Saraeva, V. V. (Moscow State Univ.). High Energy Chem. (USSR) (Engl. Transl.); 9: No. 1, 26-29(1975).

Translated from Khim. Vys. Energ.; 9: No. 1, 34-38(1975).

The radiation-induced yields of the hydroxy derivatives of pyridine in weakly alkaline and acidic solutions were determined as functions of the concentration and temperature. The yields were found to be temperature dependent. At temperatures above 30°C and a pyridine concentration greater than 1 M a chain reaction with second-order termination occurs. The acidity of the medium does not affect the oxidation process. (auth)

14313 IRRADIATION DAMAGE CENTERS IN MAGNESIUM HYPOPHOSPHITE. Koeksal, F.; Yueksel, H. (Ankara Univ. (Turkey). Dept. of Physics). Z. Naturforsch., A; 30: No. 8, 1044-1048(Aug 1975).

3 figs.; 4 tabs.; 14 refs.

An analysis of the electron spin resonance spectra of γ-irradiated crystals of magnesium hypophosphite, $Mg(H_2PO_2)_2 \times 6H_2O$, has shown that the main long-lived paramagnetic species produced by γ-irradiation are HPO_2^- and PO_2^{3-} ionic radicals. The hyperfine interaction tensor of the phosphorous nucleus has the principal values T = 1674 and T = 1221 Mc/s in HPO_2^- and T = 2490, and T = 1847 Mc/s and PO_2^{3-}. In HPO_2^-, interaction of the unpaired electron with the proton gives rise to an almost isotropic hyperfine coupling of 233 Mc/s. These results indicate that the orbitals occupied by the unpaired electron in both HPO_2^- and PO_2^{3-} are sp^3-hybrid σ-orbitals centered on the phosphorous nuclei. (DE)

14314 MECHANISM OF ELECTRON TRANSFER FROM e_{aq}^- TO ACCEPTORS IN MICELLES. Graetzel, M.; Henglein, A.; Janata, E. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (F. R. Germany). Sektor Strahlenchemie). Ber. Bunsenges. Phys. Chem.; 79: No. 5, 475-480(May 1975).

5 figs.; 17 refs.

Pulse radiolysis experiments were carried out to investigate reactions $A + e_{aq}^- \rightarrow A^-$ of hydrated electrons with acceptors A incorporated in the lipoidic part of micellar 10^{-2} M sodium lauryl sulfate (SLS) and cetyltrimethylammonium bromide (CTAB). The acceptors were 9-nitro-anthracene and pyrene, the latter in both

the singlet and triplet state (the triplet was produced by UV-light irradiation shortly before the high energy electron pulse was applied). The triplet state of pyrene reacts in CTAB-micelles with a rate constant smaller by at least a factor of two than the singlet ground state. (DE)

14315 THE UV PHOTOLYSIS (λ = 185 nm) OF LIQUID METHYL n-PROPYL ETHER. Schuchmann, H. P.; von Sonntag, C. (Max-Planck-Institut fuer Kohlenforschung, Muelheim an der Ruhr (F. R. Germany). Abt. fuer Strahlenchemie). Z. Naturforsch., B; 30: No. 3, 399-403(Jun 1975).

1 fig.; 2 tabs.; 21 refs.

The main products of the 185 nm photolysis of liquid methyl n-propyl ether (quantum yields in parentheses) are n-propanol (0.70), methane (0.29), sec-butyl methyl ether (0.20), methanol (0.16), propionaldehyde (0.13), 3,4-dimethoxyhexane (0.09), ethane (0.08), and ethyl n-propyl ether (0.08). The quantum yields of further 24 minor products have been measured. The quantum yield of the sum of primary photochemical processes, the main ones of which are the homolytic scissions of the C-O bonds, is close to unity. (DE)

14316 PULSE RADIOLYSIS OF ACETIC ACID 2-HYDROXY-ETHYL ESTER. Fast Elimination of Acetic Acid From a Primary Radical. Matsushige, T.; Koltzenburg, G.; Schulte-Frohlinde, D. (Max-Planck-Institut fuer Kohlenforschung, Muelheim an der Ruhr (F. R. Germany). Abt. fuer Strahlenchemie). Ber Bunsenges. Phys. Chem.; 79: No. 8, 657-661 (Aug 1975). 1 fig.; 1 tab.; 31 refs.

The reaction of OH radicals with acetic acid 2-hydroxyethyl ester, in aqueous solutions has been studied. A rate constant of $k_{OH+1} = 8.5 \times 10^8\ M^{-1}\ s^{-1}$ was obtained. The transients a few μs after pulse consist of approximately 83% formylmethyl radicals, CH_2CHO, the remainder being mainly $CH_2C(O)OCHCH_2OH$ radicals. Gamma radiolysis of 1N N_2O saturated aqueous solutions led to G(acetic acid) = 5.0 without contribution of a chain reaction. A lower limit of the rate constant of this reaction, at 20°C, $k \geq 5 \times 10^5\ s^{-1}$, was derived from pulse radiolysis and an upper limit of $k \leq 5 \times 10^6\ s^{-1}$ was estimated from scavenging experiments with oxygen under ^{60}Co γ-irradiation. At higher concentrations of 1, and/or higher temperatures CH_2CHO attacks 1, leading to a chain decomposition of 1 yielding acetic acid and acetaldehyde. Succinic aldehyde was identified as a product of the dimerization of CH_2CHO. (DE)

14317 GAS CHROMATOGRAPHIC ANALYSIS OF REACTION PRODUCTS FROM CHEMICAL IRRADIATION. Weeke, F.; Bastian, E.; Schomburg, G. (Max-Planck-Institut fuer Kohlenforschung, Muelheim an der Ruhr (F. R. Germany). Abt. fuer Strahlenchemie). Chromatographia; 7: No. 4, 163-170(1974). (In German)

8 figs.; 7 refs.

The products of chemical irradiation can be regarded, from the gas chromatographic point of view, as being complex mixtures whose analyses are made difficult by the large differences in volatility and concentration of the various components. Special techniques must be used in the sample preparation and introduction as well as in the exclusive separation and determination of the components of particular interest. An important role in this process is played by double column techniques with "heartcutting," "backflushing" and "trapping" in an automatically controlled closed system. (DE)

14318 PICOSECOND PULSE RADIOLYSIS. I. Time or Concentration Dependent Rate Constants. Jonah, C. D.; Miller, J. R.; Hart, E. J.; Matheson, M. S. (Argonne National Lab., IL). J. Phys. Chem.; 79: No. 25, 2705-2711(4 Dec 1975).

Rate constants for the reaction of the hydrated electron with reactive solutes at high concentrations have been measured, using our single fine-structure pulse stroboscopic apparatus. The accessible time region is 50 to 3500 psec. A time-dependent rate constant in accord with theory was found for the neutral reactant, nitromethane, whereas acetone reacting one-third as fast showed no time dependence. For e^-/sub aq/ + NO_3^- the rate constant increases with concentration (i.e., at short times), owing both to the ionic strength effect and the time dependence effect. Only time-dependent effects seem to be present in our concentration range for the reactions of the hydrated electron with IO_4^- and CrO_4^{2-}. Ionic strength effects seem to be absent, probably because tunneling extends the reaction radii to about 10 A where coulomb forces between the reactants are small. Cd^{2+} reacts with e^-/sub aq/ at nearly the diffusion-limited rate so that no Cd^{2+} ion atmosphere can form about surviving e^-/sub aq/. Thus, reacting Cd^{2+} has an anion atmosphere but e^-/sub aq/ reacts without a cation sheath in pure $Cd(ClO_4)_2$ solution, and this decreases the effect of ionic strength on the rate constant. The effect is estimated from experimental data. Cu^{2+} reacts at half the diffusion-limited rate so a partial Cu^{2+} atmosphere can build up about e^-/sub aq/. (auth)

14319 RADIOLYSIS OF COMPOUNDS IN SOLUTION. Model Calculations on the Effects of Concentration, Impurity, and Dose Rate. Rice, R. N.; Gorin, G.; Raff, L. M. (Oklahoma State Univ., Stillwater). J. Phys. Chem.; 79: No. 25, 2717-2722(4 Dec 1975).

The kinetic behavior of compounds subjected to radiolysis in solution has been investigated for a generalized mechanism that comprises an infinite number of consecutive reactions between the radiolysis products and radicals (Z·) derived from the solvent. When steady-state conditions for these primary radicals exist, it is rigorously shown that the dose, D/sub x/, required to convert any desired fraction x of the original solute A_1 into products varies linearly with the initial A_1 concentration, A_0, regardless of the number of steps in the process and independently of whether or not A_1 decreases exponentially with dose. Furthermore, it is demonstrated that the slope of the linear plot measures the reactivity of A_1 and all products derived therefrom with (Z·), while the intercept measures the reactivity of (Z·) with solute-independent impurities that may be present. The kinetic behavior of the system is independent of dose rate when only consecutive steps are involved in the radiolysis mechanism. The characteristics of radiolysis mechanisms that involve reaction of the solute with secondary products of the radiolysis have also been investigated. Such mechanisms do not, in general, yield linear plots of D/sub x/ vs A_0. The deviation from linearity are, in fact, a measure of the reactions of solute with secondary products. Model calculations also show that the kinetic behavior of such systems depends on the dose rate. This dependence can, under the proper conditions, become manifest at much lower dose rates than that due to reactions of primary and secondary intermediates with one another. (auth)

14320 FORMATION OF RADICAL CATIONS OF METHOXY-LATED BENZENES BY REACTION WITH OH RADICALS, Tl^{2+}, Ag^{2+}, AND SO_4^- IN AQUEOUS SOLUTION. An Optical and Conductometric Pulse Radiolysis and In Situ Radiolysis Electron Spin Resonance Study. O'Neill, P.; Steenken, S.; Schulte-Frohlinde, D. (Max-Planck-Institut fuer Kohlenforschung, Muelheim, Ger.). J. Phys. Chem.; 79: No. 25, 2773-2779(4 Dec 1975).

The reactions of anisole, 1,2-, 1.3-, and 1,4-dimethoxybenzene and 1,2,3-, 1,2,4-, and 1,3,5-trimethoxybenzene with Tl^{2+}, Ag^{2+}, SO_4^-, and OH, respectively, were investigated in aqueous solution using optical and conductometric pulse radiolysis and in situ radiolysis ESR for detection. Tl^{2+} and Ag^{2+} were produced by reaction of OH with Tl^+ and Ag^+, respectively. SO_4^- was generated by reaction of e^-/sub aq/ with persulfate. Tl^{2+}, Ag^{2+}, and SO_4^- react with the methoxylated benzenes by electron transfer to yield radical cations and Tl^+, Ag^+, and SO_4^{2-}, respectively. In the absence of cyclohexadienyl radicals the radical cations decay by second-order kinetics with rate constants ranging from less than 4×10^3 to $1 \times 10^9\ M^{-1}\ sec^{-1}$ depending on the positions of the methoxy groups relative to each other. OH radicals react with the methoxylated benzenes by addition to the aromatic ring with diffusion-controlled rates. Depending on conditions, the hydroxycyclohexadienyl radicals thus formed subsequently undergo three different types of reaction: (a) bimolecular decay (k values ranging from 8×10^8 to $2 \times 10^9\ M^{-1}\ sec^{-1}$); (b) reaction with protons to yield radical cations (k values from 2×10^8 to $1.4 \times 10^9\ M^{-1}\ sec^{-1}$); and (c) reaction with radical cations (k values from 8.6×10^8 to $3.5 \times 10^9\ M^{-1}\ sec^{-1}$). The assignment of the optical absorption spectra of the radical cations and the determination of the respective extinction coefficients is based on a combination of optical and conductivity data. The radical cation yield obtained at pH 1 by reaction of protons with the OH adducts of the substrates amounts to greater than 90 percent in the case of anisole, 1,3-dimethoxybenzene, and 1,3,5-trimethoxybenzene. (auth)

14321 THE OXIDATION AND REDUCTION OF SUCCINIC ACID BY IONIZING RADIATION. Budzinski, E.E.; Box, H.C. (Biophysics Department, Roswell Park Memorial Institute, Buffalo, New York 14263). J. Chem. Phys. 63: No. 11, 4927-4929 (1 Dec 1975).

The oxidation of succinic acid was observed by ESR-ENDOR spectroscopy in single crystals x irradiated at 4.2 °K. Oxidation products result from loss of hydrogen from the saturated carbon atoms as well as from the carboxyl groups. Reduction is a more specific process; electrons are captured by carbonyl oxygen atoms. The competition for electrons between succinic acid and fumaric acid in doped crystals was examined at 4.2 °K. (auth)

Radiochemistry and Nuclear Chemistry

Refer also to abstracts 15900 and 15901.

14322 (LF-62) PROGRESS REPORT, 1974. Rudstam, G. (ed.). (Forskningsraadens Lab., Studsvik (Sweden)). 1974. 57p. Dep. NTIS (US Sales Only) $4.50.

The current projects carried out by the research groups working at the Swedish Research Councils' Laboratory are summarized. Research was conducted in the following fields: nuclear structure, nuclear spectroscopy, neutron diffraction, nuclear chemistry, radiation chemistry, solid-state physics, and theoretical studies of condensed matter. Lists of publications are given with the appropriate sections. (RWR)

14323 STATE AND FUTURE OF NUCLEAR CHEMISTRY. Lieser, K. H. (Technische Univ. Darmstadt (F. R. Germany). Fachbereich Anorganische Chemie und Kernchemie). Umsch. Wiss. Tech.; 75: No. 18, 557-562(Sep 1975). (In German)

5 figs.

Fundamental research in the field of nuclear chemistry comprises such topics as superheavy elements, nuclear reactions including fission, actinide chemistry and chemical effects of nuclear reactions. Nuclear industry is of increasing importance and involves many important branches of chemistry. Radiochemistry and nuclear techniques have widespread applications in chemical analysis, kinetics, biology, medicine and other fields of science and industry. (DE)

Hot-Atom Chemistry

Refer also to abstracts 15327 and 15624.

14324 (CRN-CNPA-75-9) SZILARD–CHALMERS EFFECTS IN HAFNIUM CHELATES. I. Radiochemical Analysis. Marques–Netto, A.; Abbe, J. C. (Centre National de la Recherche Scientifique, 67- Strasbourg (France). Centre de Recherches Nucleaires). 1975. 14p. INIS.

Solid hafnium complexes of EDTA and CDTA together with the Na and NH_4 salts have been synthesized. The retentions following (n,γ) activation have been measured for ^{180m}Hf and ^{181}Hf. The influences of the irradiation times and of thermal annealing have been investigated. (FR)

14325 FAST SEPARATION IN THE GASEOUS PHASE OF Te AND I RECOIL PRODUCTS PRODUCED BY ^{252}Cf. Boegl, W.; Baechmann, K.; Buettner, K. (Technische Univ. Darmstadt (F.R. Germany). Fachbereich Anorganische Chemie und Kernchemie). Radiochim. Acta; 21: No. 1, 33-40(1974).

6 figs.; 7 tabs.; 49 refs.

The transportation of Te and I nuclides (produced by a Cf-252 source) out of the spontaneous fission products with N_2, Ar, N_2-Cl_2, N_2-CCl_4, N_2-O_2 and $N_2-Cl_2-O_2$ in the gas phase has been investigated. The separation yields are given as a function of the composition, the temperature of the transfer tube, the temperature of the cooling trap and the streaming velocity. The chemical composition of some of the transported species are discussed. (DE)

14326 REACTIONS OF RECOIL FLUORINE IN LIQUID HALOBENZENES. Berei, K.; Vasaros, L. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). Radiochim. Acta; 21: No. 1, 75-80(1974).

From 6th international hot atom chemistry symposium; Upton, N.Y. (7 Sep 1971). 2 figs.; 4 tabs.; 27 refs.

Experimental investigations of halogen and hydrogen replacements in liquid halobenzenes by nucleogenic fluorine atoms from the $^{19}F(n,2n)^{18}F$ process are reported. Liquid binary mixtures of hexafluorobenzene with each of the four monohalobenzenes were irradiated with a 14 MeV neutron generator. The hexafluorobenzene served both as the source of ^{18}F and as one of the participants in the intermolecular competition reactions. Iodine and bromine were used as scavengers. The products of ^{18}F-for-halogen and ^{18}F-for-hydrogen replacements were identified by gas chromatography. The results are compared with the earlier data on the reactions of hot chlorine, bromine, and iodine with aromatic compounds. The ^{18}F obeys the same rules found to govern the replacement reactions of the other nucleogenic halogen atoms. The results are discussed in terms of a mechanism that involves a highly inelastic atom-molecule collision and formation of an excited intermediate complex. (DE)

14327 RELATIVE REACTIVITIES OF ETHANE, ETHANE-d_6, n-BUTANE, AND NEOPENTANE TOWARDS "HOT" TRITIUM ATOMS. Urch, D. S. (Queen Mary Coll., London (UK). Dept. of Chemistry); Welch, M. J. (Washington Univ., St. Louis, Mo. (USA). Edward Mallinckrodt Inst. of Radiology). Radiochim. Acta; 21: No. 1, 81-87(1974).

4 figs.; 5 tabs.; 17 refs.

The reactions of recoil tritium with ethane–butane, and ethane–neopentane mixtures have been studied in the presence and absence of helium moderator. It is shown that the larger molecules are labelled by recoil atoms of a higher mean energy than those which label ethane. It is also shown that hydrogen atoms at CH_2 sites are replaced by higher energy tritium atoms than those at CH_3 sites. An analogy is drawn with the abstraction reaction and a simple unified model for high-energy recoil tritium reactions at a C-H site is proposed. The more complex the other groups attached to the carbon the greater the mean energy of the recoil atoms reacting with the C-H bond. Experiments with ethane-d_6 established that the primary isotope effect for abstraction is comparable to that for displacement with a value of ~1.25 to 1.30. (DE)

14328 ISOTOPE EFFECTS IN HOT HYDROGEN CHEMISTRY. Malcolme-Lawes, D. J. (Kent Univ., Canterbury (UK). Chemical Lab.). Radiochim. Acta; 21: No. 1, 105-109(1974).

8 figs.; 1 tab.; 14 refs.

A hard-sphere energy transfer model is applied to the abstraction reactions H (D,T) + RH (D,T) → H_2 etc. + R. The excitation functions derived over the energy range 0.5 to 30 eV indicate that two high energy isotope effects result from purely kinematic considerations: 1) an attacking atom isotope effect, which predicts that the efficiency of high energy abstraction increases as the mass of the attacking atom increases; and 2) a struck atom isotope effect, which predicts that the abstraction efficiency decreases as the mass of the struck atom increases. All the isotopic combinations of the abstraction reaction lead to the formation of translationally excited products, so that the yields from such processes are likely to be influenced by collisional dissociation. (DE)

14329 RADIATIVE NEUTRON CAPTURE IN SODIUM CHROMATES. Stamouli, M. I. (Democritus Nuclear Research Center, Athens (Greece). Dept. of Chemistry). Radiochim. Acta; 21: No. 1, 90-95(1974).

8 figs.; 1 tab.; 14 refs.

The distribution of ^{51}Cr activity among $^{51}Cr(VI)$, $^{51}CR(III)$-monomer and $^{51}Cr(III)$-dimer + polymer species has been investigated in hydrated and anhydrous sodium chromate and dichromate salts irradiated with neutrons at room and liquid nitrogen temperature. The presence of water of crystallization was found to have a considerable effect on the activity distribution. The thermal and radiation annealing of the various salts has been studied. The effect of dehydration after the neutron irradiation is also described. (DE)

14330 REACTIONS OF IODINE-123 ATOMS WITH BENZENE IN THE LIQUID PHASE. Muxart, R.; Vernois, J.; Strapelias, H. (Paris-6 Univ., 75 (France). Lab. de Chimie Physique). Radiochim. Acta; 21: No. 1, 88-89(1974). (In French).

1 fig.; 14 refs.

The reactions of nucleogenic ^{123}I atoms with liquid benzene has been studied. In the absence of a scavenger, the total organic yield is 18-20% and the yield of C_6H_5I is 7%. In the presence of I_2 the total organic yield decreases from 15 to 11% between 10^{-4} and 5×10^{-3}mf of iodine. The yield of C_6H_5I is not much affected by the presence of iodine. (DE)

14331 SYNTHESIS OF TECHNETIUM AND RHENIUM PHTHALOCYANINES BY RECOIL IMPLANTATION. Yoshihara, K. (Tohoku Univ., Sendai (Japan). Faculty of Science); Wolf, G. K.; Baumgaertner, F. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Heisse Chemie). Radiochim. Acta; 21: No. 1, 96-100(1974).

2 figs.; 3 tabs.; 12 refs.

The synthesis of technetium and rhenium phthalocyanines was undertaken by recoil implantation of isotopes generated by (d,xn) reactions in a mixture of molybdenum or tungsten (or its oxide) with copper phthalocyanine. Radioactive isotopes of technetium and rhenium were found unambiguously in the copper phthalocyanine sublimate and the fraction, which was dissolved in concentrated sulfuric acid and coprecipitated with copper phthalocyanine by dilution of the solution with water. This behaviour shows the properties expected for technetium phthalocyanine about which little is known. The most probable valence state of technetium and rhenium in the complex seems to be 4+. Annealing and isotope effects were also observed. (DE)

Properties of Radioactive Materials

Refer also to abstracts 14228, 15114, and 15162.

14332 (MLM-2234) DISSOLUTION METHODS. Silver, G. L. (Mound Lab., Miamisburg, Ohio (USA)). 6 Jan 1976. Contract E-33-1-Gen-53. 23p. Dep. NTIS $4.00.

This review of dissolution procedures contains one hundred suggestions and references about the dissolution of various substances. Work and dissolution are illustrated with a work diagram for plutonium. (auth)

14333 (UCRL-77709) PREPARATION OF CALIFORNIUM DIIODIDE. Wild, J. F.; Hulet, E. K.; Lougheed, R. W.; Hayes, W. N. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1975. 10p. (CONF-750112-4). Dep. NTIS $3.50.

From symposium commemorating the 25th anniversary of the discovery of elements 97 and 98; Berkeley, USA (20 Jan 1975).

The preparation and identification of the hexagonal and rhombohedral forms of CfI_2 are reported. (LK)

14334 FLUORIDES OF RADON AND ELEMENT 118. Pitzer, K. S. (Univ. of California, Berkeley). J. Chem. Soc., D; No. 18, 760-761(17 Sep 1975).

Relativistic quantum mechanics as applied to radon (or element 118) fluoride structures indicates that ionic crystalline forms are probably more stable for the fluorides of these elements in contrast to the molecular form of xenon fluorides. (auth)

14335 HIPPURAN-^{131}I; PREPARATION AND PURITY CONTROL. Belkas, E. P.; Hiotellis, E.; Dassiou, C. (Democritus Nuclear Research Center, Athens). Int. J. Appl. Radiat. Isot.; 26: No. 10, 629-631(Oct 1975).

A simple method for the preparation of Hippuran-^{131}I based on isotopic exchange in aqueous solution is described. The method gives a final product of high radiochemical purity suitable for medical use. The radiochemical controls undertaken on the material are reported. Biological control was performed by obtaining a renogram and by scintiscanning after injection of the material into a rabbit. (UK)

14336 CRYSTAL STRUCTURE OF TETRACAESIUM OCTAISOTHIOCYANATOURANATE (IV). Bombieri, G. (Consiglio Nazionale delle Ricerche, Padua); Moseley, P. T.; Brown, D. J. Chem. Soc. (London), Dalton Trans.; No. 15, 1520-1523 (1975).

The structure of Cs_4 [$U(NCS)_8$] has been determined by single-crystal x-ray diffraction methods from diffractometer data on 845 reflections and refined to R 0.06. Crystals are tetragonal, space group P 4/n with a_0 = 11.958(6), c_0 = 11.170(6) Å, Z = 2. The two sets of four nitrogen atoms co-ordinated to the uranium atom [at distances of 2.38(3) and 2.46(3) Å, respectively] are arranged at the vertices of an almost perfect square antiprism. The results are discussed in relation to the structure of $[NEt_4]_4$ [$U(NCS)_8$] and spectral data for both compounds. (auth)

14337 THERMOCHEMISTRY OF URANIUM COMPOUNDS. VI. Standard Enthalpy of Formation of Cesium Diuranate $Cs_2U_2O_7$. Thermodynamics of Formation of Cesium and Rubidium Uranates at Elevated Temperatures. O'Hare, P. A. G.; Hoekstra, H. R. (Argonne National Lab., IL). J. Chem. Thermodyn.; 7: No. 9, 831-838(Sep 1975).

From IAEA symposium on thermodynamics of nuclear materials; Vienna, Austria (Oct 1974).

Cesium diuranate, $Cs_2U_2O_7$, was reacted with 1 mol dm^{-3} HCl in a solution calorimeter. The enthalpy of reaction, –(46087 ± 102) cal_{th} mol^{-1}, leads to a standard enthalpy of formation, $\Delta H_f^\circ(Cs_2U_2O_7, c, 298.15K)$, of –(754.3 ± 1.6) $kcal_{th}$ mol^{-1}. Thermodynamics of the Cs + U + O and Rb + U + O systems are discussed with particular emphasis on the formation of cesium and rubidium uranates and diuranates in nuclear reactor fuel. Formation of the monouranates is expected to predominate, although diuranates are also predicted to form, but in rather low concentrations. (auth)

14338 LUMINESCENCE DURING OXYGEN ADSORPTION ON THORIUM OXIDE. Breysse, M.; Claudel, B.; Faure, L.; Latreille, H. (CNRS, Villeurbanne, France). Faraday Discuss. Chem. Soc.; 58: 205-214(1974).

Some novel features concerning the light emitted during oxygen adsorption on thorium oxide surfaces are presented and discussed. The variation of light intensity with time reveals the existence, after the initial peak, of a secondary maximum depending on the conditions of the previous surface treatment with hydrogen Carbon monoxide added to the oxygen causes this secondary maximum to vanish. Finally, the spectrum of emitted light consists, in the visible region, of a broad structureless band, between about 500 and 800 nm. These findings are interpreted as due to the possible occurrence of two radiative transitions between adsorbed species: (I) $O_{2ads} + e^- \rightarrow O_{2ads}^-$; (II) $O_{ads} + e^- \rightarrow O_{ads}^-$. (auth)

14339 PREPARATION OF A ^{125}I LABELED DERIVATIVE OF PENICILLIN TO BE USED FOR RADIOIMMUNOASSAY. Wal, J. M.; Kann, G. (Institut National de Recherches Agronomiques (INRA), 78-Jouy-en-Josas (France). Lab. de Recherches sur les Additifs Alimentaires; Centre National de Recherches Zootechniques (CNRZ), 78-Jouy-en-Josas (France). Lab. de Physiologie de la Lactation). C. R. Hebd. Seances Acad. Sci., Ser. D; 280: No. 20, 2405-2408(26 May 1975). (In French)

A ^{125}I-BSA Penicilloyl conjugate was prepared by coupling penicillin G to Bovine Serum Albumine previously labeled with iodine-125. The reaction of fixation by covalent binding was made in alkaline solution without the use of carbodiimide. Immunoreactivity and specific activity of this labeled conjugate enable radioimmunoassay of penicilloyl groups. (FR)

14340 ELECTRON CONFIGURATION OF LANTHANIDES AND ACTINIDES. Kanellakopulos, B. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Heisse Chemie). Chem. Ztg.; 97: No. 10, 515-521(1973). (In German)

10 figs.; 8 tabs.; 56 refs.

The article presents a brief review on the electronic structure of the 4f- and 5f-elements. The lanthanide and actinide elements take a particular position in the periodic system as "inner transition elements" due to the specific properties of the f-electrons. These properties determine the behavior of the free ions and their chemical compounds. Several characteristic parameters and their relations to the electronic configuration are briefly discussed. Similarities and discrepancies between the lanthanide and actinide series are emphasized. (DE)

14341 REDOX BEHAVIOUR OF NEPTUNIUM AT TRACER CONCENTRATIONS IN AQUEOUS SOLUTIONS. I. Acidic Solutions. Duplessis, J.; Genet, M.; Guillaumont, R. (Paris-11 Univ., 91 - Orsay (France). Lab. de Radiochimie). Radiochim. Acta; 21: No. 1, 21-28(1975). (In French).

8 figs.; 17 refs.

The conversion of Np(IV) into Np(V) and vice versa at tracer conditions was examined in hydrochloric acid media as a function of several factors: element concentration, acid concentration, alkalization, dilution, and recovery of the residue from dry evaporation of Np(V)HCl or $HClO_4$-solutions. Conditions were established for the preparation and conservation of extremely dilute hydrochloric acid solutions of Np(IV) or Np(V) in the absence of foreign redox pairs. Still at tracer levels chemical and electrochemical reduction of Np(V) into Np(IV) and then into Np(III) was studied. It is difficult to obtain and more difficult to characterize Np(III) in hydrochloric media using these two methods, contrary to what takes place in the solutions of a weighable amount of the element. Results reveal that it is possible to reduce at tracer level and by a strictly electrochemical technique one ion to another ion with a lower degree of oxidation. (DE)

14342 COMPLEXATION OF SOME TRANSURANIUM ELEMENTS WITH TROPOLONE AND β-ISOPROPYLTROPOLONE. Cilindro, L. G.; Keller, C. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Radiochemie). Radiochim. Acta; 21: No. 1, 29-32(1974).

3 figs.; 2 tabs.; 17 refs.

The complexation of Np(V), Am(III), Cm(III) and Cf(III) with tropolone and β-isopropyltropolone in aqueous solution at 25°C and ionic strength 0.1 has been investigated. NpO_2^+, studied by spectrophotometric titration, formed 1:1- and 1:2-chelates with both complexing agents. Am(III), Cm(III) and Cf(III) are extracted as 1:3-chelates, using $CHCl_3$ as the organic phase with the stability constants β_3 increasing in the above-written sequence. In all cases, the β-isopropyltropolonate chelates were found to be more stable than the tropolonates of the corresponding transuranium elements. (DE)

14343 CHEMICAL STATE OF ^{106}Rh FROM ^{106}Ru(phen)$_3^{2+}$ AND THE RAPID SEPARATION OF ^{106}Rh BY EXTRACTION METHOD. Takamatsu, T.; Koyama, M.; Fujinaga, T. (Kyoto Univ. (Japan). Dept. of Chemistry). Radiochim. Acta; 21: No. 1, 101-104(1974).

9 figs.; 6 refs.

The extraction behavior of ion association systems, which consisted of 1,10-phenanthroline chelates of Ru(II) and Rh(III) and perchlorate ions, were investigated in order to elucidate the chemical effects associated with the β decay of ^{106}Ru. As a result, it was concluded that the decomposition of tris-chelate was not significant and most of ^{106}Rh was found in the form of $Rh(phen)_3^{3+}$. The thus developed extraction technique was applied to the rapid separation of ^{106}Rh from ^{106}Ru. By reverse phase chromatography, ^{106}Rh could be milked out within a few seconds with the decontamination factor of approximately 10^4. (DE)

14344 REDOX BEHAVIOUR OF NEPTUNIUM IN TRACER QUANTITIES IN AQUEOUS SOLUTIONS. II. Alkaline Solutions. Espinosa, E.; Genet, M.; Guillaumont, R. (Paris-11 Univ., 91 - Orsay (France). Lab. de Radiochimie; Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Radiochim. Acta; 21: No. 1, 41-48(1974). (In French).

11 figs.; 13 refs.

The preparation and identification of the oxidation states V, VI, and VII of tracer quantities of neptunium (^{237}Np) have been studied in alkaline solution. Two analytical methods have been investigated: glass fiber electrophoresis and solvent extraction. By means of electrophoresis Np(V) was separated from Np(VI) and Np(V) from Np(VII), but not Np(VI) from Np(VII). The occurrence of exchange reactions between Np(V) and Np(VI) and between Np(VI) and Np(VII) were demonstrated. The solvent extraction (DBM + butyl acetate) of Np(V) from an alkaline solution is due to a synergism. If Np(V) is oxidized to Np(VI) at room

temperature by bromine the extraction of the latter is different from that of Np(V). The same behaviour is observed if solutions of Np(VI) containing Br_2 are heated or ozonized. This allows the conclusion that Np(VII) is formed in these extremely dilute neptunium solutions. Extraction conditions are described for the separation of Np(V) from Np(VI) and Np(VI) from Np(VII). (DE)

14345 DETERMINATION OF THE PERIOD AFTER THE PURIFICATION OF ^{233}U WITH CONCOMITANT ^{232}U AND DAUGHTERS. Hashimoto, T. (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.); Imai, T. (Kanazawa Univ. (Japan). Radiochemical Lab.). Radiochim. Acta; 21: No. 1, 69-72(1974). 4 figs.; 2 tabs.; 16 refs.

The time elapsed after the chemical purification of a ^{233}U sample was experimentally determined by evaluating the relationship of the alpha activities of the concomitant ^{232}U and its daughters (^{228}Th and ^{224}Ra). In order to determine the activity ratio of ^{224}Ra to ^{232}U, alpha spectrometry with a silicon surface barrier detector was applied. The sample was dried on a stainless steel plate. A pure ^{232}U, produced by the neutron capture reaction of Pa-231 in a reactor and the subsequent β-decay, was examined to confirm the usefulness of this method. The experimentally determined value of 204 ± 3 days was in good agreement with the known period of 202 days after the chemical purification of ^{232}U sample. In case of an ^{233}U sample, an experimental value of 2,003 ± 25 days was obtained. (DE)

14346 METHOD FOR ESTIMATING ACIDITY CHANGES IN PLUTONIUM SOLUTIONS. Silver, G. L. (Mound Lab., Miamisburg, Ohio (USA)). Radiochim. Acta; 21: No. 1, 54-56(1974). 6 refs.

A method for estimating the conditions of final equilibrium solution acidity and valence state distribution for plutonium given only the initial solution acidity and plutonium average oxidation number is illustrated with an example. (DE)

14347 ADSORPTION AND COLLOIDAL BEHAVIOUR OF CARRIER-FREE ^{7}Be IN AQUEOUS SOLUTIONS. Benes, P.; Jiranek, V. (Ceske Vysoke Uceni Technicke, Prague (Czechoslovakia). Katedra Jaderne Chemie). Radiochim. Acta; 21: No. 1, 49-53(1974). 7 figs.; 1 tab.; 18 refs.

The state of carrier-free ^{7}Be in aqueous nitrate solutions was studied by electrophoresis, centrifugation, and dialysis. In solutions of pH ≤ 4 beryllium is present mainly as Be^{2+} cation. At pH > 4 hydrolysis of beryllium proceeds and results in the formation of $BeOH^+$ ions and $Be(OH)_2$ molecules. The larger part of these molecules is adsorbed on the surface of colloidal impurities present in the solution. The pseudocolloids thus formed are positively charged up to pH 11. In alkaline solutions (pH > 11), negatively charged pseudocolloids and anionic hydroxocomplexes of beryllium exist. Adsorption and desorption of carrier-free beryllium was studied on glass, plexiglass, and polyethylene as a function of pH, age, and ionic strength ($NaNO_3$) of the solution. Adsorption begins at pH 3-5, passes through a maximum at pH 8-11, and decreases to a very low value at pH 14. Probable mechanisms of the adsorption were discussed. (DE)

14348 HEAT CAPACITY, ENTROPY, ENTHALPY, AND GIBBS ENERGY OF $^{242}PuF_4$ FROM 10 TO 350 °K. Osborne, D.W.; Flotow, H.E.; Fried, S.M.; Malm, J.G. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439). J. Chem. Phys. 63: No. 11, 4613-4617 (1 Dec 1975).

Heat capacity measurements have been made on a 20.9 g sample of $^{242}PuF_4$ from 10 to 350 °K. The measurements from 20 to 350 °K were made by intermittent electrical heating with corrections based on the observed temperature drifts. Heat capacities determined in this way were compared with temperature drifts without electrical heating in the range 20 to 56 °K to evaluate the radioactive self-heating rate as (1.214±0.004) $\times 10^{-4}$ W/g Pu. From 10 to 20 °K heat capacities were obtained from this value of the radioactive self-heating rate and the temperature drifts without electrical heating. The heat capacity curve had the normal sigmoid shape. At 298.15 °K the heat capacity C_p, entropy $S°$, enthalpy $H°-H°_0$, and tempered Gibbs energy $(G°-H°_0)/T$ are, respectively (116.19±0.29) J °K^{-1}· $mole^{-1}$, (147.25±0.37) J °K^{-1}· $mole^{-1}$, (22 385±56) J $mole^{-1}$, and −(72.17±0.18) J °K^{-1}· $mole^{-1}$. The changes in various thermodynamic functions for the formation of $PuF_6(g)$ from $PuF_4(c)$ and $F_2(g)$ are evaluated at 550 and 298.15 °K. (auth)

14349 HYPERFINE AND SUPERHYPERFINE EPR SPECTRA OF Tc(IV) AND Re(IV) IN TIN DIOXIDE SINGLE CRYSTALS. Pieper, H.H.; Schwochau, K. (Institut für Chemie der Kernforschungsanlage Jülich GmbH, Institut 1 : Nuklearchemie, D−517 Jülich, Germany). J. Chem. Phys. 63: No. 11, 4716-4722 (1 Dec 1975).

The electron paramagnetic resonance spectra of Tc(IV) and Re(IV) in tin dioxide have been observed at *X*- and *Q*-band frequencies at liquid helium temperature. Both ions with a spin ground state of $S=3/2$ occupy lattice sites of D_{2h} symmetry. The hyperfine structures show large anisotropies, especially in the case of Re(IV), which can be explained by the large crystal field parameters. The spectra fit with a conventional spin Hamiltonian for orthorhombic symmetry correspond to the electron transition $1/2 \leftrightarrow -1/2$. The obtained parameters for the *c*-axis and the magnetic *z*-axis coincident are

SnO_2 : Tc(IV)	$g_x = 1.972$	$\|D\| = 74$ GHz	$A_x = 152$ GHz
	$g_y = 1.962$	$\|E\| = 6$ GHz	$A_y = 164$ GHz
	$g_z = 1.975$		$A_z = 166$ GHz
SnO_2 : Re(IV)	$g_x = 1.626$	$\|D\| = 53.2$ GHz	$A_x = 730$ GHz
	$g_y = 1.593$	$\|E\| = 9.5$ GHz	$A_y = 493$ GHz
	$g_z = 1.81$		$A_z = 427$ GHz

Besides the hyperfine lines, both systems exhibit a partly resolved superhyperfine structure due to an interaction of the unpaired electrons with adjacent tin nuclei. (auth)

Radioactive Waste Treatment

Refer also to abstract 15373.

14350 (ANL-75-63) CHEMICAL ENGINEERING DIVISION WASTE MANAGEMENT PROGRAMS, Quarterly Report, April-June 1975. Steindler, M. J.; Levitz, N. M.; Mecham, W. J. (Argonne National Lab., Ill. (USA)). Jul 1975. Contract W-31-109-Eng-38. 32p. Dep. NTIS $5.00.

Consolidation techniques for Zircaloy fuel-cladding hulls were studied. They included (1) further work on a pyrochemical-volatility scheme for separating the zirconium as the volatile tetrachloride and (2) ignition tests and shock-ignition tests on several Zircaloy materials to further characterize the pyrophoric behavior of Zircaloy and the impact on hulls management. Quantitative results on the reaction with molten zinc chloride are presented. A series of steel-melting experiments examined the compatibility of various crucible materials with the molten steel and provided information on the behavior (distribution) of CeO_2 and UO_2 (used as stand-ins for PuO_2). Examination of existing information on deep-well injection of industrial wastes and on low-level aqueous wastes from fuel reprocessing led to the conclusions that the technology is generally available from industrial practice, that costs are of the order of 10^{-4} mill/kWh, that environmental effects could be insignificant in normal operation (but could include contamination of groundwater and resources and also stimulation of minor earthquakes in maloperation), that legal constraints may be the most significant barrier to adopting the practice, and that the site of such an operation would best be at a fuel reprocessing plant located at one of the U. S. sedimentary basins. The conclusions and recommendations from a study of the reliability of high-level-waste canisters are presented. (auth)

14351 (BARC-796) STUDIES ON REMOVAL OF METHYL IODIDE BY ACTIVATED CHARCOAL. Khan, A. A.; Ramarathinam, K.; Deshingkar, D. S.; Kishore, A. G. (Bhabha Atomic Research Centre, Bombay (India)). 1975. 21p. Dep. NTIS (US Sales Only) $3.50.

Air borne radioiodine is present in several different chemical forms of which methyl iodide is most difficult to confine. In an attempt to find a suitable adsorber for methyl iodide confinement, four different activated charcoals were studied for their methyl iodide removal efficiency. To improve the removal efficiency of an indigenous activated charcoal it was impregnated with potassium iodide and hydrazine hydrate. Fifteen samples of different impregnated charcoals were also evaluated. A suitable impregnated charcoal is suggested for methyl iodide confinement. (auth)

14352 (MLM-2262) MONSANTO/MOUND LABORATORY TRITIUM WASTE CONTROL TECHNOLOGY DEVELOPMENT PROGRAM. Bixel, J. C.; Kershner, C. J.; Rhinehammer, T. B. (Mound Lab., Miamisburg, Ohio (USA)). 30 Dec 1975. 14p. (CONF-750967-21). Dep. NTIS $4.00.

From third ERDA environmental protection conference; Chicago, Illinois, USA (23 Sep 1975).

Over the past four years, implementation of tritium waste control programs has resulted in a 30-fold reduction in the gaseous tritium effluents from Mound Laboratory. However, to reduce tritium waste levels to the "as low as practicable" guideline poses problems that are beyond ready solution with state-of-the-art tritium control technology. To meet this advanced technology need, a tritium waste control technology program was initiated. Although the initial thrust of the work under this program was oriented toward development of gaseous effluent treatment systems, its natural evolution has been toward the liquid waste problem. We contend that, of all the possible approaches to disposal of tritiated liquid wastes, recovery offers the greatest advantages. End products of the recovery processes would be: (1) water detritiated to a level below the Radioactivity Concentration Guide or detritiated to a level

that would permit safe recycle in a closed loop operation and, (2) enriched tritium. The detritiated water effluent could be either recycled in a closed loop operation such as in a fuel reprocessing plant or safely released to the biosphere, and the recovered tritium could be recycled for use in fusion reactor studies or other applications. (auth)

14353 HAW GLASS PARTICLES IN A METAL MATRIX. A Solidification Product for Highly Radioactive Solutions Suitable for Final Storage. Heimerl, W. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Chemische Technologie). Atomwirtsch., Atomtech.; 20: No. 7, 347-349(Jul 1975). (In German).

3 figs.; 12 refs.

Today glass is generally regarded as a suitable vitrification product for the high-level fission product solutions produced in reprocessing spent nuclear fuels. Vitrification is carried out after the addition of suitable agents to the dried and concentrated fission product solutions at temperatures between 900 and 1,200°C. However, in addition to many advantages, glass suffers from the decisive drawback of not being in a thermodynamic equilibrium. In order to avoid the problems connected with glass blocks, the method outlined in this report was developed. Glass balls of 4-5 mm diameter are imbedded in metal, for instance in lead. A pilot plant is in operation at the Juelich Nuclear Research Center. (DE)

Radioisotope Production

Refer also to abstract 14984.

14354 (AEC-tr-7315) RADIATION TECHNOLOGY, ISSUE 6. Translation of Radiats. Tekh.; No. 6, (1971). 240p. (TT-72-58020). Dep. NTIS $7.60.

The publication deals with theoretical and experimental works on the nuclear-physical basis of radiation technology, isotope thermoelectric generators, equipment irradiation, pulse proton generator, nuclear methods of analysis, gamma flaw detection, radiotherapeutic and x-ray diagnostic equipment. The technical experience in the preparation of the separate units of radiation technology and the description of articles prepared in VNIIRT are given. Beta thickness gauge of films, experimental hose gamma therapeutic apparatus for in-cavity irradiation, radioisotope scintillation level-gauge-regulator, and a universal radioisotope relay apparatus are discussed. The economical effectiveness of new gamma flaw detectors, the technico-economical indicators of installations of neutron activation analysis, and a logical structural model of forecasting radiation technology are covered. Individual abstracts were included for each item. (auth)

For abstracts of individual sections see: 14229, 14230, 14254, 14255, 14355, 14356, 14786–14790, 14870–14872, 14947–14952, 14998–15002, 15007–15010, 15015, 15039, 16101, 16102, 16121, 16123, and 16124.

14355 (AEC-tr-7315, pp 2-10) PRODUCTION OF ISOTOPES FORMED THROUGH AN INTERMEDIATE NUCLEUS BY NEUTRON CAPTURE. Terent'ev, V. P.; Zharkov, V. A.; Fradkin, I. M.; Chavychalova, T. P. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

The alpha-emitter isotopes (^{238}Pu, ^{242}Cm, ^{244}Cm, ^{210}Po, and others) are beginning to play a leading role in the general balance of radioisotope indicators. They can be received by irradiation in the nuclear reactor according to the following scheme. The nucleus of the practically stable initial isotope captures a neutron forming an intermediate nucleus, which decays with a sufficiently small half-life period (not more than a few days) into the nucleus of the isotope of interest. The production process can be divided into individual cycles. Each cycle includes preparation of the initial product, its irradiation in the reactor, and the chemical separation of the produced isotope from the remaining starting material. In the following, the choice of the regime of irradiation for each cycle is discussed. For this purpose, the fate of the material of the first batch is traced in the case of its complete use in subsequent cycles. The condition of obtaining a maximum amount of the fuel isotope is chosen as a criterion of optimization of the process. (auth)

14356 (AEC-tr-7315, pp 11-13) USE OF NEUTRONS FOR THE PRODUCTION OF RADIOACTIVE ISOTOPES. Fradkin, G. M.; Zharkov, V. A.; Terent'ev, V. P. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

The isotopic fuels considered can be divided into two groups according to their modes of formation. The first group contains ^{60}Co, ^{170}Tm, and ^{192}Ir, which do not differ in chemical properties from the initial isotopes. The second group contains ^{210}Po, ^{227}Ac, ^{232}U, ^{238}Pu, ^{242}Cm, and ^{244}Cm, which have an atomic number higher by unity than the atomic number of the initial isotopes. The irradiation requirements for each group are stated. (LK)

14357 APPARATUS FOR ELUTING A DAUGHTER RADIOISOTOPE FROM A PARENT RADIOISOTOPE. Harris, O. A. (to Mallinckrodt Chemical Works). US Patent 3,912,935. 14 Oct 1975. Filed date 15 Oct 1973. 2p.

Apparatus for eluting a sterile daughter radioisotope from a parent radioisotope including a case, a generator having a supply of the parent radioisotope therein, a primary shield enclosing the generator for shielding against radioactive emissions from the parent radioisotope, and an annular wall extending up from the bottom of the case defining a compartment for reception of the primary shield thereby to hold the latter in position within the case is described. A vertical web extends between the annular wall and an exterior wall of the case. An auxiliary shield of suitable shielding material (e.g., lead) generally of the height of the primary shield is provided, this auxiliary shield having an inner cylindric surface conforming generally to the outer surface of the annular wall and having a slot therein for receiving the web. Thus, with the auxiliary shield positioned in the case adjacent the annular wall and with the web received by the slot, the auxiliary shield is held by the web in position in the case for shielding the user from excessive radioactive emissions from the generator in the event the radioactive emissions from the generator exceed the shielding capability of the primary shield. (auth)

14358 PRODUCTION OF RADIONUCLIDES. Sameh, A. A. (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Radiochemie). KFK Nachr.; 7: No. 2, 31-32(Jul 1975). (In German).

2 figs.; 11 refs.

Work on the production of transplutonium elements at Karlsruhe Nuclear Research Centre and on the isolation of Mo-99 for the fabrication of technetium generators is briefly surveyed. Some remarks are made on the use of these preparates in the R + D activities of the centre. The process systems used in reprocessing are presented in two photographs. (DE)

Reactor Fuel Reprocessing

Refer also to abstracts 16240, 16244, 16267, 16301, and 16302.

14359 (CNEA-EN-41/133) COMPARATIVE STUDY OF THE REPROCESSING PLANTS IN THE WORLD. Sergo Anich, J. A. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). 1974. 66p. (In Spanish). INIS.

In order to obtain optimum conditions to satisfy the energy requirements of industrial reprocessing, a comparative study was made of reprocessing plants in various countries. By means of a series of tables and data compilations information is given on the following points: number of plants, country of origin, type and composition of the fuel and fuel cans, start-up date for the plant, pre-treatment, type of process, capacity, production capacity, enrichment, wastes, final product, coolants, capital investment, costs, and useful life of the installation. Data are given for Eurochemic, Marcoule, La Hague UP-2 and AT-1, Eurex, Itrec, Madrid, Dounreay, Windscale, Wak, Kjeller, Trombay, Tarapur, Tokai Mura, Nuclear Fuel Service, Barnwell Nuclear Fuel Plant, Atlantic Richfield Reprocessing Plant, General Electric Midwest Fuel Recovery Plant, Idaho Chemical Processing Plant, Oak Ridge, Savannah River, and Hanford. (tr-INIS)

14360 (CONF-751101-26) RESIN-BASED PREPARATION OF HTGR FUELS: URANIUM LOADING DEVELOPMENT STUDIES. Haas, P. A. (Oak Ridge National Lab., Tenn. (USA)). 1975. 4p. Dep. NTIS $4.00.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum; San Francisco, California, USA (16 Nov 1975).

Uranium leading flowsheet conditions for recycle ^{233}U were investigated and demonstrated in engineering equipment. Calculations made to estimate the capacities of equipment which is geometrically safe with respect to control of nuclear criticality indicate 100 kg/day or more of uranium for a single nitrate extraction line with four batch loading contactors. The four batch contactors might be replaced by a single continuous resin loading contactor of a modified Higgins contactor design. The resin loading process using solvent extraction of nitrate appears practical for use in a commercial-scale HTGR fuel recycle plant. (auth)

14361 (DOCKET-50201-171) WEST VALLEY REPROCESSING PLANT. Safety Analysis Report, Supplement 17. (Nuclear Fuel Services, Inc., Rockville, Md. (USA)). 31 Oct 1975. 129p.

Responses to U. S. Nuclear Regulatory Commission questions on seismology and geology, meteorology, and hydrologic engineering and revised pages and replacement drawings are contained in this supplement. (LK)

14362 (DOCKET-50201-172) WEST VALLEY REPROCESSING PLANT. Environmental Report No. 18, January-June 1975. (Nuclear Fuel Services, Inc., Rockville, Md. (USA)). 25 Aug 1975. 30p. Dep. NTIS $5.00.

Environmental conditions and discharge data from the West Valley Processing Plant during the first half of 1975 are reported. (LK)

14363 (DOCKET-50332-55) BARNWELL NUCLEAR FUEL PLANT. Environmental Report, October 1975 Update. (Allied-Gulf Nuclear Services, Barnwell, S. C. (USA)). Oct 1975. 38p. Dep. NTIS $5.00.

Allied-General's plans for solid waste storage and on ground water at the Barnwell site are discussed. (LK)

14364 (DOCKET-701308-5) MIDWEST FUEL RECOVERY PLANT. Environmental Impact Appraisal Related to License Amendment. (General Electric Co., San Jose, Calif. (USA). Nuclear Fuels Dept.). 3 Dec 1975. 52p. Dep. NTIS $5.50.

The environmental aspects of the proposed amendment to increase the spent fuel receipt and storage capacity at the Morris Operation facility from 100 metric tons of uranium to 750 metric tons of uranium by redesigning storage baskets and racks are discussed. (LK)

14365 (GERHTR-139) TRITIUM IN REPROCESSING PLANTS: A STUDY OF THE INVENTORY, BEHAVIOR, AND THE POSSIBILITIES OF SEPARATION OF THE TRITIUM ISOTOPE. Schnez, H.; Laser, M.; Merz, E. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Chemische Technologie). Aug 1974. Translation of JUL-1099-CT. 85p. Dep. NTIS $6.00.

Work performed under United States-German High Temperature Reactor Research Exchange Program.

The path followed by tritium in reprocessing plants is described in quantitative terms based on the Purex and Thorex processes. Flowsheets are given for the Purex process which are on the one hand based on the present state of technology, but make provision at the same time for a recycling of the aqueous phase and a tritium separation. As an alternative approach the technical and economic aspects have been examined of a prior separation of the tritium after reduction of the fuel elements, followed by separation from the aqueous phase. The ultimate storage and transport of the separated tritium were included in the cost determination. The conclusion is reached as a result of the study that tritium separation is possible on scientific and technical grounds. The estimates made show the financial outlay to be less than 10 DM/GWh, but may on occasion be substantially higher, since no practical or industrial experience of the process is yet available. (auth)

14366 COMPRIMO'S NUCLEAR ACTIVITIES. Atoomenerg. Haar Toepass.; 17: No. 10, 206-209(Oct 1975).

Since Comprimo started their activities in the nuclear field (in 1956), the Company has been engaged in the design, procurement, supply, erection and start-up of a wide range of installations and plants, i.e., from uranium enrichment to fuel-element reprocessing. Comprimo's activities are outlined in relation to some current projects. (NL)

14367 METHOD OF CHEMICAL REPROCESSING OF IRRADIATED NUCLEAR FUELS (ESPECIALLY FUELS CONTAINING URANIUM). Koch, G. (to Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (F. R. Germany)). German(FRG) Patent 1,592,410/B/. 22 May 1975. 6p. (In German)

A method is described for the extraction especially of fast breeder fuels of high burnup. A quaternary ammonium nitrate of high molecular weight is put into an organic diluting medium as extraction agent, corresponding to the general formula $NRR'R''R'''NO_3$ where R,R' and R'' are aliphatic radicals, R''' a methyl radical, and the sum of the C atoms is greater than 16. After the extraction of the aqueous nitric acid containing nuclear fuel solution with this extracting agent, uranium, plutonium (or also thorium) can be found to a very high percentage in the organic phase and can be practically quantitatively back-extracted by means of diluted nitric acid, sulphuric acid or acetic acid. By using 30 volume percent tricaprylmethylammonium nitrate in diethylbenzene for example, a distribution coefficient of 10.3 is obtained for uranium. (DE)

CONTROLLED THERMONUCLEAR RESEARCH

Plasma Confinement and Heating

14368 (CONF-710994-P3, pp 241-264) THEORETICAL PRINCIPLES OF PLASMA HEATING. Blaha, A. (Vysoka Skola Technicka, Bratislava). 1971. (In Slovak)

From 5th scientific conference of the Institute of Mining and Metallurgy; Ostrava, Czechoslovakia (14 Sep 1971).

In fifth scientific conference VSB. Vol. III.

Principles of static and dynamic heating of various types of plasma are dealt with. (INIS)

14369 (CONF-750356-, pp H11-H119) EXPERIMENTAL STUDIES OF TURBULENT HEATING OF PLASMAS BY CROSS FIELD ELECTRIC CURRENTS. Hintz, E. (Kernforschungsanlage, Juelich, Ger.). 1975.

From 2nd international congress on waves and instabilities in plasmas (SICWIP); Innsbruck, Austria (17 Mar 1975).

In second international congress on waves and instabilities in plasmas. Survey lectures.

The collisionless dissipation of energy as a result of collective interaction of particles is of fundamental importance in plasma physics and can also be of great practical interest. The existence of a rather well developed theory for the turbulent plasma state in case of strong electric currents flowing perpendicular to a weak magnetic field, and the availability of theoretical predictions on the anomalous electric conductivity have made the experimental investigation of this case especially attractive. At Julich this subject has been studied for two different experimental situations (A) In the front of hydromagnetic shock waves at low β and large $\omega_{ce}\tau_{ei}$; (B) in the imploding current sheath of a fast, low density θ pinch. For case (A) the dependence of the effective electron ion-collision frequency V_{eff} on characteristic parameters like T_e/T_i, v_d/v_{the}, ω_{pe} has been determined. As for most of the published work a resolution of the shock front was not possible within this parameter study, and only mean values of V_{eff} could be obtained. Recently, however, space-resolved measurements of the plasma parameters have been performed for one set of parameters from which the profiles of T_e/T_i, v_d/v_{the}, V_{eff} could be derived. The maximum value of V_{eff} shows a significant deviation from the mean values and agrees quite well with theoretical predictions. In case (B) a rather coarse determination of V_{eff} from measured electron heating rates and magnetic diffusion rates, respectively, yielded $V_{eff} \propto \omega_{pi}$. A careful investigation of the sheath was performed for one favorable set of initial parameters. The combined application of several diagnostic methods allowed a detailed description of the turbulent plasma state in the sheath, on the basis of which a very informative comparison of experimental results with theoretical predictions about ion sound turbulence is possible. (auth)

14370 (CONF-750356-, pp V1-V17) GENERAL FEATURES OF RADIO FREQUENCY HEATING OF TOROIDAL PLASMAS. Vandenplas, P. E. (Ecole Royale Militaire, Brussels). 1975.

From 2nd international congress on waves and instabilities in plasmas (SICWIP); Innsbruck, Austria (17 Mar 1975).

In second international congress on waves and instabilities in plasmas. Survey lectures.

A new generation of large tokamaks intended to test the possibility of attaining physical parameters corresponding to ignition are being designed (PLT, TIO, JET). It is the aim of the present lecture to summarize bounded plasma studies both on the heating of present tori and on an extension of this approach to larger machines in order to examine which rf methods promise to furnish strong additional heating of the plasma. In particular, it is stressed that the coincidence of a strong bounded plasma resonance of the toroidal cavity with the angular frequency $\omega \sim \kappa_{||} V_e(\kappa_{||}$: wavelength along the axis of the torus; V_e: electron thermal velocity) makes electron transit time magnetic pumping (electron TTMP) a very attractive and efficient method for large thermonuclear devices. This is a feature which had been hitherto largely overlooked. (auth)

14371 (CONF-751125-129) RADIO FREQUENCY PLASMA HEATING IN LARGE TOKAMAK SYSTEMS NEAR THE LOWER HYBRID RESONANCE. Deitz, A.; Hooke, W. M. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). 1975. 12p. Dep. NTIS $3.50.

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The frequency range, power, efficiency, and pulse length of a high power rf system are discussed as they might be applied to the TFTR Tokamak facility as well as on a full scale reactor. Comparisons are made of the size, power output, and costs to obtain microwave power sufficient to satisfy the physics requirements. A new microwave feed concept is discussed which will improve the coupling of the microwave energy into the plasma. The unique advantages of waveguide feed systems is apparent when one considers the practical problems associated with coupling supplementary heating energy into a reactor. (auth)

14372 (CONF-751125-130) 200 kW, 800 MHz TRANSMITTER SYSTEM FOR LOWER HYBRID HEATING. Deitz, A. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). 1975. 16p. Dep. NTIS $3.50.

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

This paper describes a new rf heating system which has just been completed and is now operational on the ATC machine. The system utilizes four UHF TV klystrons to generate at least 200 kW of power at a frequency of 800 MHz. Pulse widths can be varied from 20 mu sec up to 20 msec. A radar type floating deck modulator along with photo-optical transmitting and receiving devices have been incorporated into the system to provide the pulse fidelity and versatility which characterizes this equipment. Modular construction was emphasized in the design, when possible, to reduce maintenance and down time in the advent of component failure. Hybrid combining techniques are utilized in order to provide two 100 kW feeds into the machine. (auth)

14373 (COO-2218-60P) PRELIMINARY STUDY OF SUPRATHERMAL ALPHA PARTICLE HEATING. Miley, G. H.; Petrie, T. W.; Rao, M. P.; Hively, L. H. (Illinois Univ., Urbana (USA)). 1975. 11p. (CONF-751130-18). Dep. NTIS $3.50.

From APS meeting; St. Petersburg, Florida, USA (10 Nov 1975).

Some of the consequences of the suprathermal orbits on particle confinement and heating are examined. The guiding-center approximation along with the conservation equations of energy, magnetic moment, and canonical angular momentum were used in the analysis. An example calculation is presented. (MOW)

14374 (EUR-CEA-FC-774) LOCATION OF THE LOWER HYBRID HEATING ABSORPTION ZONE IN TOROIDAL DEVICES. Lallia, P. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de la Physique du Plasma et de la Fusion Controlee). Jun 1975. 20p. Dep. NTIS (US Sales Only) $3.50.

The location of the transformation of the incident electromagnetic wave into an electrostatic plasma wave near the lower hybrid resonance can be determined by using the "warm" plasma theory. This region corresponds roughly to the linear absorption region or to the source of non linear waves, since there the electric field is maximum. A numerical determination of this region is made for two toroidal devices: the WEGA Stellarator and the JET Tokamak. (auth)

14375 (MATT-1180) FUSION REACTIVITIES AND NEUTRON SOURCE CHARACTERISTICS OF BEAM-DRIVEN TOROIDAL REACTORS WITH BOTH D AND T INJECTION. Jassby, D. L.; Towner, H. H. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). Jan 1976. Contract E(11-1)-3073. 60p. Dep. NTIS $5.45.

The reactor performance is considered for intensely beam-driven tokamak plasmas with 50:50 D-T composition maintained by neutral-beam injection of both D and T, together with plasma recycling. The D and T are injected with equal intensity and velocity. This mode of operation is most appropriate for high-duty-factor, high-power-density operation, in the absence of pellet injection. The isotropic velocity distributions of energetic D and T ions (for multi-angle injection) are calculated from a simple slowing-down model, but include a tail above the injection velocity. The neutron source characteristics are determined from fusion reactivities calculated for beam-target, hot-ion, and thermonuclear reactions. For conditions where Q approximates 1, beam-target reactions are dominant, although reactions among the hot ions contribute substantially to P/sub fusion/ when n/sub hot//n /sub e/ greater than or equal to 0.2. (auth)

14376 (N-74-34200) STUDY OF THE METHODS FOR THE PRODUCTION AND CONFINEMENT OF HIGH ENERGY PLASMAS. Final Report, 1 April-30 September 1972. Cheng, D. Y.; Wang, P. (Santa Clara Univ., Calif. (USA). School of Engineering). 30 Sep 1972. 29p. (NASA-CR-140443). NTIS $4.50.

The injection of dense plasmas into a B sub z long magnetic field from both ends of the field coil was investigated. Deflagration plasma guns and continuous flow Z-pinch are discussed along with the possibility of a continuous flow Z-pinch fusion reactor. The injection experiments are described with emphasis on the syn-

chronization of the two plasma deflagration guns, the collision of the two plasma beams, and the determination of plasma density. (STAR)

14377 (TRITA-EPP-75-02) OHMIC PLASMA HEATING BY POLOIDAL CURRENTS IN AN INTERNAL RING SYSTEM. Ohlsson, D. (Kungliga Tekniska Hoegskolan, Stockholm (Sweden). Institutionen foer Plasmafysik med Fusionsforskning). Jan 1975. 47p. Dep. NTIS (US Sales Only) $4.00.

Ohmic heating by induced currents along the magnetic field lines is investigated for a plasma confined in an internal ring system with a main poloidal magnetic field. Special attention has been focused on the energy, the transverse momentum, and the plasma-neutral particle balances. (auth)

14378 (UCID-16962) COLD COMPONENT FLOW IN A TWO-COMPONENT MIRROR MACHINE. Rognlien, T. D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Dec 1975. Contract W-7405-Eng-48. 35p. Dep. NTIS $4.00.

Steady-state solutions are given for the flow characteristics along the magnetic field of the cold plasma component in a two-component mirror machine. The hot plasma component is represented by a fixed density profile. The fluid equations are used to describe the cold plasma, which is assumed to be generated in a localized region at one end of the machine. The ion flow speed, v/sub i/, is required to satisfy the Bohm sheath condition at the end walls, i.e., v/sub i/ greater than or equal to c/sub s/, where c/sub s/ is the ion-acoustic speed. For the case when the cold plasma density, n/sub c/, is much less than the hot plasma density, n/sub h/, the cold plasma is stagnant and does not penetrate through the machine in the zero temperature case. The effect of a finite temperature is to allow for the penetration of a small amount of cold plasma through the machine. For the density range n/sub c/ approximately n/sub h/, the flow solutions are asymmetric about the midplane and have v/sub i/ equals c/sub s/ near the midplane. Finally, for n/sub c/ much greater than n/sub h/, the solutions become symmetric about the midplane and approach the Lee–McNamara type solutions with v/sub i/ equals c/sub s/ near the mirror throats. (auth)

14379 (UCRL-Trans-10981) ONE-DIMENSIONAL NUMERICAL EXPERIMENT ON PARAMETRIC HEATING OF PLASMA. Part I. Sigov, Yu. S.; Khodyrev, Yu. V. (AN SSSR, Moscow). Nov 1975. Translation of Preprint No. 129. 13p. Dep. NTIS $3.50.

Some results of a one-dimensional numerical experiment on high-frequency plasma heating with an external field of frequency omega$_0$ equals 1.005 omega/sub pe/ and amplitude E_0 root 4pi n_0T /sub e_0/ equals 1 are presented. The excitation of an aperiodic branch of parametric instability is demonstrated. The effective collision frequency and the proporation of non-Maxwellian electrons are estimated. (auth)

14380 QUANTUM THEORY OF INVERSE BREMSSTRAHLUNG ABSORPTION AND PAIR PRODUCTION. Seely, J. F. (Univ. of Tennessee, Knoxville). pp 835-847 of Laser Interactions and Related Plasma Phenomena. Vol. 3. New York; Plenum Press (1974).

The inverse Bremsstrahlung process is believed to play an important role in the heating of plasma electrons by laser radiation. In this process, an electron absorbs energy from the laser beam during a collision with a nucleus. From a classical viewpoint, the electron oscillates in the electric field of the laser beam. During a collision with a nucleus, the electron is knocked out of phase with the electric field, and the oscillatory energy of the electron is converted to random thermal energy. From a quantum viewpoint, the electron can gain energy only in units of Dirac constant omega, where omega is the frequency of the laser radiation, and it is not clear that the classical theory is valid. The quantum theory of inverse Bremsstrahlung absorption is discussed, and compared with the quantum results to the classical results. (auth)

14381 THEORETICAL INTERPRETATIONS OF ENHANCED LASER LIGHT ABSORPTION. Kruer, W. L. (Lawrence Livermore Lab., CA). pp 5-26 of Progress in Lasers and Laser Fusion. Perlmutter, A. (ed.). New York; Plenum Press (1975).

From Orbis scientist meeting; Coral Gables, Florida, USA (21 Jan 1975). See CONF-750110-P2.

Classical inverse bremsstrahlung is discussed in relation to plasma heating. Some plasma heating experiments are reviewed. A brief discussion is given of light absorption at high intensity (greater than or equal to 10^{15} W/cm^2, Nd), emphasizing the importance of density profile modifications and the possibility of stimulated scattering of light from the plasma. (MOW)

14382 SURFACE MAGNETIC CONFINEMENT. Wong, A.Y.; Nakamura, Y.; Quon, B.H.; Dawson, J.M. (Department of Physics, University of California, Los Angeles, California 90024). Phys. Rev. Lett. 35: No. 17, 1156-1160 (27 Oct 1975).

We discuss advantages of surface confinement such as plasma stability, direct injection of ion beams, electrostatic confinement, negligible synchrotron loss, and "geometric mirror." Preliminary experimental results are presented. (auth)

14383 COMMENT ON CHARGED-PARTICLE SCATTERING IN DILUTE AND DENSE PLASMAS IN THE PRESENCE OF INTENSE ELECTROMAGNETIC RADIATION. Choi, C.K. (Department of Physics, Southern Illinois University, Carbondale, Illinois 62901); Mian, S.N.; Henneberger, W.C.; Shatas, R.A. Phys. Rev. A 12: No. 6, 2635-2637 (Dec 1975).

It is shown that the quantum theory in the Born approximation gives the classical result when scattering of electrons in the presence of a radiation field occurs in a time short with respect to the period of the radiation. It is argued that the result of Bunkin and Fedorov may be used only when the collision frequency of the electrons in a plasma is much smaller than the frequency of the electromagnetic radiation. (auth)

14384 PLASMA RESONANCE IN THE X—RAY EMISSION FROM GASEOUS LASER TARGETS. Yablonovitch, E. (Gordon McKay Laboratory, Harvard University, Cambridge, Massachusetts 02138). Phys. Rev. Lett. 35: No. 20, 1346-1349 (17 Nov 1975).

I report the first observation of CO_2-laser-induced x-ray emission from *gaseous* targets. By varying the gas pressure, the plasma density of the target was tuned through resonance at the critical density. The x-ray emission rose quickly from zero at the critical pressure, and reached a peak when the plasma was slightly overdense. Because of the resonant enhancement, a CO_2-laser pulse of only 0.1 J was sufficinet for this experiment. (auth)

14385 HIGH-ENERGY RUNAWAY ELECTRONS IN THE OAK RIDGE TOKAMAK. Knoepfel, H.; Zweben, S.J. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). Phys. Rev. Lett. 35: No. 20, 1340-1343 (17 Nov 1975).

Measurement of hard x-rays produced in normal ORMAK discharges provides direct evidence that runaway electrons can be produced at early times and can be contained stably during the whole discharge time, thereby attaining energies of the order of 10 MeV. This class of high-energy runaway electrons complements and extends previous information on runaways in toroidal discharges and can have some distinct consequences on the operation of future tokamak devices. (auth)

14386 HOT SPOTS IN LASER PLASMAS. Craxton, R.S.; Haines, M.G. (Department of Physics, Imperial College, London SW7 2BZ, England). Phys. Rev. Lett. 35: No. 20, 1336-1339 (17 Nov 1975).

Spontaneously generated magnetic fields can substantially reduce the thermal conductivity in pellet atmospheres and give rise to localized hot spots, which may lead to the ablation of anomalously fast ions. (auth)

14387 PLASMA HEATING BY RELATIVISTIC ELECTRON BEAMS. II. RETURN CURRENT INTERACTION. Thode, L.E.; Sudan, R.N. (Laboratory of Plasma Studies, Cornell University, Ithaca, New York 14850). Phys. Fluids 18: No. 11, 1564-1573 (Nov 1975).

The combined interactions of the relativistic two-stream instability and return current driven Buneman/ion sound instability are investigated by numerical simulation for a beam-to-plasma density ratio $\simeq 10^{-1}$ and $\gamma = 2-8$. In this regime the evolution of the two-stream instability is relatively unaffected by the return current instability. The growth rate of the Buneman instability drops sharply when trapping of plasma electrons by the unstable Buneman waves occurs, but wave growth continues at a much reduced rate until other processes, e.g., ion acceleration, wave scattering, and nonlinear Landau damping set in. Ions are heated by the return current and this heating is almost independent of the initial beam γ for constant return current. The bulk of the electron distribution is heated, whereas in the absence of a return current the two-stream instability primarily produces only energetic tails. The total plasma electron energy after several hundred plasma periods is proportional to the beam energy. The effective collision frequency of the plasma electrons due to microturbulence is typically $0.2 \simeq 0.4\ \omega_{pi}$, where ω_{pi} is the ion plasma frequency. In the strong turbulence created by the electron beam and the return current, the wave energy spectrum scales as $|E_k|^2 \simeq k^{-2}$. (auth)

14388 PLASMA HEATING BY RELATIVISTIC ELECTRON BEAMS. I. TWO-STREAM INSTABILITY. Thode, L.E.; Sudan, R.N. (Laboratory of Plasma Studies, Cornell University, Ithaca, New York 14850). Phys. Fluids 18: No. 11, 1552-1563 (Nov 1975).

A one-dimensional model of the two-stream instability between a relativistic electron beam and a plasma shows that the saturated level of the wave electric field is determined by a single parameter. Due to relativistic effects, the efficiency of energy transfer via the hydrodynamic two-stream instability is a decreasing function of total beam energy in the strongly relativistic regime. The model is supported by numerical simulation experiments. The spectrum of the spatial harmonics generated during the buildup of the primary spectrum obeys a power law

dependence. Anomalous heating of the electrons via parametric instability driven by the primary spectrum is observed. For long times the beam energy loss is proportional to the initial beam kinetic energy and most of this energy is picked up by the hot tail of the plasma electron distribution. (auth)

14389 HIGH-BETA CONFINEMENT IN TENQ: AN AXISYMMETRIC TOROIDAL EXPERIMENT WITH NON-CIRCULAR CROSS-SECTION. Dippel, K. H.; Graffmann, E.; Hoenen, F. (Kernforschungsanlage, Juelich, Ger.). pp 57-67 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

A report is given on a high-β-plasma confinement experiment with elongated cross-section in an axisymmetric toroidal geometry. Objectives of the experiment, principles of operation, theoretical aspects, a description of the apparatus and first experimental results are presented. A stable confined state of the plasma at a toroidal current of 200 kA and a β of 0.3 has been observed. (auth)

14390 PULSED TOROIDAL SYSTEM WITH AUTOMATED CONFINEMENT CHAMBER. Es'kov, A. G.; Zolotovskii, O. A.; Kalygin, A. G.; Kurtmullaev, R. Kh.; Laukhin, Ya. N.; Malyutin, A. I.; Markin, A. I.; Proshletsov, A. P.; Semenov, V. N. (Inst. of Atomic Energy, Moscow). pp 71-82 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975). (In Russian).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

This work presents experimental results dealing with some urgent problems concerning toroidal systems: shaping and heating of toroidal plasma at temperatures $T \sim 10^3$ eV, dynamics of hot toroidal plasma with elongated cross-section, and means of suppressing impurities. The method chosen for solving these problems has bearing on the following fundamental points: (1) pulsed shaping and heating of plasma configuration with closed magnetic fields; (2) conveyance of the plasma toroid to an automated quasi-stationary confinement chamber. The possibility of attaining the required configuration by rapidly re-connecting opposing magnetic fields at the ends of the system has been demonstrated experimentally. Investigations were conducted in two representative modes: without an axial conductor with purely poloidal configuration of the magnetic field, and with an axial conductor for $H_\theta \neq 0$. The lifetime of the plasma formation without the toroidal field H_θ proved to be an order of magnitude greater than the value of $\tau \sim l/v_A$, which evidently is related to peculiarities in the behavior of the magnetic field in toroidal geometry with an elongated cross-section. The migration of plasma toroid shaped and heated in an impact chamber into a stationary confinement chamber has been determined according to a series of independent measurements. (auth)

14391 IMPORTANCE OF SELF-FORMING PROCESSES IN PINCH DISCHARGES FOR PLASMA HEATING AND CONFINEMENT. Kvartskhave, I. F. (Physical-Technical Inst., Sukhumi, USSR); Mateev, Yu. V.; Butov, I. Ya.; Samarskii, A. A.; Kurdyumov, S. P.; Popov, Yu. P. pp 149-160 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975). (In Russian).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

Experimental evidence is presented for self-forming processes in high-current pinch discharges (lamination, self-destruction of thin plasma sheaths, repeated discharge triggering at the discharge chamber wall, vaporization of the chamber, etc.) for the heating and magnetic confinement of a plasma. An experimental approach involving condensation of the working gas at the chamber wall, whereby normally undesirable self-forming phenomena become a factor making for an improvement in the thermonuclear parameters of the discharge plasma is proposed. High-current discharge in lithium is modelled numerically with allowance for "secondary breakdown". This is considered high in the framework of one-dimensional non-stationary equations of radiative magnetohydrodynamics with assumption of axial symmetry. It was shown that radiational transport of energy plays a significant role in the dynamics of the discharge. Optimum plasma compression and heating regimes are indicated. (auth)

14392 keV COLLISIONLESS THETA-PINCH PLASMA CONFINED IN THE CAULKED-CUSP TORUS (CCT) FIELD. Uchid, T.; Sato, K.; Noda, N.; Aizawa, T.; Osanai, Y.; Itagaki, T.; Akiyama, R. (Nagoya Univ., Japan). pp 161-169 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

At the Madison Conference, it was reported that a periodic caulked-cusp field can suppress the toroidal drift of a toroidal theta-pinch plasma as well as stabilize it. In this paper, it is demonstrated that a theta-pinch plasma produced in the low-pressure regime is confined stably for a longer time — about 80 μs — in the caulked-cusp-torus (CCT) field by using the second CCT-II machine, which is larger and fatter and has fewer rings than the first machine, CCT-I, used at the time of the Madison Conference. The energy distribution of the theta-pinch-plasma particles is studied by means of an energy analysis of the fast neutral particles emitted from the confined plasma. It is found that the plasma confinement time is limited to 80 μs by the decrease of the confining-field strength due to the decay of the crowbarring current and the induced ring-current, while the density decay time is estimated to be 120 μs. These results are also confirmed by measurements of the time variation of the spectral lines $H_\beta(D_\beta)$ and of the continuum, due to bremsstrahlung. (auth)

14393 SCREW PINCH SHAPED BY TOROIDAL-CURRENT-BAR CONTROL. Yokoyama, K.; Nogi, Y.; Ito, M.; Itagaki, T.; Kawakami, I.; Yoshimura, H. (Nihon Univ., Tokyo). pp 171-179 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

Both the suppression of toroidal drift and the shaping of the screw-pinch cross-section are performed by the currents in four toroidal bars located inside the toroidal coil. Experimental results show that the confinement of the screw-pinch plasma is performed with a large compression ratio and a large q-value. Numerical calculations of equilibrium configurations using an MHD-code are in agreement with the experimental results. The rapid decrease of the plasma current in the decay stage may be caused by the decrease of the separatrix cross-section which may be due to the decay of the toroidal field. (auth)

14394 CO_2 LASER BREAKDOWN AND HEATING OF HYDROGEN IN A MAGNETIC MIRROR FIELD. Offenberger, A. A.; Burnett, N. H. (Univ. of Alberta, Edmonton, Canada). pp 217-229 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

A 1-GW, 125-J CO_2-laser pulse focussed by a 10-cm focal-length parabolic mirror was used to induce breakdown and heating in 15-torr hydrogen along the axis of a short 50-kGauss magnetic mirror field. Evolution of the breakdown plasma thus produced has been studied by high-speed photography, ruby-laser Thomson scattering and a Mach-Zehnder interferometer. Results indicate an efficient radial confinement of plasma by the mirror field with an electron temperature much enhanced over that resulting from a field-free breakdown. An electron temperature of ~100 eV has been measured near the laser focus at the end of the gain-switched CO_2-laser spike in the mirror field compared to ~20 eV at the same time in a field-free breakdown. Interferometric measurements show that breakdown results in a cylindrical plasma with an electron density minimum on axis in both cases. A monitor of the transmitted CO_2-laser pulse indicates very incomplete coupling of laser radiation into the plasma column with the field applied, presumably because of fraction losses at the entrance boundary of the breakdown. Experimental results agree qualitatively at early times with a numerical hydrodynamic calculation which neglects axial plasma expansion and assumes complete coupling of the laser into the breakdown column. (auth)

14395 THEORETICAL STUDIES OF PLASMA HEATING BY RELATIVISTIC ELECTRON BEAMS. Papadopoulos, K.; Chu, K. R.; Clark, R. W. (Naval Research Lab., Washington, DC). pp 231-240 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381-(Vol.3); CONF-741105-P3.

A summary of ongoing theoretical investigations with respect to plasma heating by relativistic electron beams is presented. The investigations include nonlinear stabilization by parametric effects, nonlinear saturation of cold two-stream instability, 2D-particle simulations, studies of the filamentation instability, formation of and plasma heating by rotating electron beams and expansion of a column of beam-heated plasma. (auth)

14396 PLASMA HEATING USING STRONG TURBULENCE AND RELATIVISTIC ELECTRON BEAMS. Kribel, R. E.; Ekdahl, C. E.; Greenspan, M.; Sethian, J.; Sandel, F.; Wharton, C. B. (Cornell Univ., Ithaca, NY). pp 241-248 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381-(Vol.3); CONF-741105-P3.

A mirror-confined plasma column (plasma density n/sub p/ less than or equal to 6×10^{13} cm^{-3}) was heated by current-driven turbulence and by the injection of a relativistic electron beam along the magnetic field. In experiments performed with low-current beams (beam current I less than or equal to 21/sub A/ equals 2 x 17 kA) the energy per electron-ion pair transferred to the plasma increased linearly with the beam to plasma density ratio n/sub b//n/sub p/. In these experiments the electron heating is attributed to the electron-electron beam plasma interaction while the energetic ions are probably produced by an electrostatic acceleration. After heating, the plasma column oscillates radially with a frequency omega proportional to the Alfven velocity (omega varies as B n^{-1}/sub p/ where B is the confining field). At the higher plasma densities, energetic confined electrons were detected, and are attributed to interactions with waves propagating at large angles to the beam. (auth)

14397 PLASMA HEATING WITH A ROTATING RELATIVISTIC ELECTRON BEAM. Molvig, K.; Rostoker, N.; Dothan, F. (Univ. of California, Irvine). pp 249-256 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381-(Vol.3); CONF-741105-P3.

Previously studied processes by means of which energy is transferred from an intense relativistic electron beam to a plasma involve instabilities associated with the primary energetic electrons and indirect coupling of the plasma return current. For return current coupling, a simple treatment based on diffusion equations was developed so that boundary conditions, pulse shape, etc., can be accounted for. This treatment was applied to a rotating beam produced, for example, by passing an annular beam through a magnetic cusp. The result is that an electric field is set up within the plasma by the Hall effect. The magnitude of this electric field is E/sub r/ equals 300(n/sub p//n/sub p/)B/sub z/ where n/sub b/ is the beam density, and n/sub p/ is the plasma density; E/sub r/(kV · cm^{-1}) and B/sub z/(kG) are the electric and magnetic fields. The guiding-center drift of electrons at velocity v/sub theta/ equals cE/sub r//B/sub z/ accounts for the plasma return current. Ions for which the magnetic field can be neglected would be accelerated in the E/sub r/-field to multi-kilovolt energy. The stopping power of the beam is greatly enhanced compared to a non-rotating beam, and the energy is almost entirely transferred to the ions. The coupling does not involve instabilities. (auth)

14398 HEATING OF PLASMA BY A POWERFUL RELATIVISTIC ELECTRON BEAM IN A STRONG MAGNETIC FIELD. Arzhannikov, A. V.; Breizman, B. N.; Vyacheslavov, L. N.; Koidan, V. S.; Konyukhov, V. V.; Ryutov, D. D. (Inst. of Nuclear Physics, Novosibirsk, USSR). pp 257-269 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975). (In Russian).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

The results of an experimental investigation into the interaction of a powerful relativistic electron beam with plasma in the INAR apparatus are presented. The relativistic electron beam had initial energy of 1 MeV, maximum injection current of 10 kA, duration of 70 ns, and diameter of 2 cm. The total beam energy at entry into the plasma was approximately 300 J. The beam was injected into the column of a hydrogen plasma 230 cm long, 8 cm in diameter, and with a density of 3×10^{14} cm^{-3}. The magnetic field had mirror-trap geometry (mirror ratio 1.7, intensity in the uniform portion up to 15 kOe). In the experiments, various diagnostic methods were used, making it possible to measure the beam current, the total current within the plasma, the total energy of the beam entering and leaving the plasma, and the distribution of beam current over the cross-section at the plasma outlet; opposing high-energy electrons were recorded. The density of the preliminary plasma was controlled during the experiment; the energy content of the plasma was determined from diamagnetic measurements; the electron distribution function was analyzed by the method of Thomson scattering of light at 90°. From an analysis of the shape of the diamagnetic signals and distribution of diamagnetism along the length of the apparatus it was established that under the assumption of predominant electron heating, the temperature of plasma electrons in order of magnitude equals 1 keV for a plasma density of 5×10^{13} cm^{-3}. The cause of heating cannot be dissipation of the reversed current. According to Thomson scattering of laser radiation, the authors established the presence of a comparatively cold plasma component with temperature of 25 eV. High-energy electrons moving from the opposite direction toward the beam were recorded; their appearance evidently was associated with acceleration of plasma electrons in the induction fields. Mechanisms which can provide effective heating of the whole mass of electrons under conditions in which pair collisions are minor are indicated. (auth)

14399 TURBULENT HEATING OF PLASMAS IN HIGH MAGNETIC FIELDS BY MEANS OF STRONG CURRENTS. Schrijver, H.; Rutgers, W. R.; Van Elst, J. A.; Post, H. A.; Kalfsbeek, H. W.; Piekaar, H. W.; De Kluiver, H. (FOM-Instituut voor Plasmafysica, Rijnhuizen, Jutphaas, Netherlands). pp 271-285 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

The results of a series of systematic measurements on the state of a plasma during heating by currents with drift velocities above the ion-acoustic speed are given. A hollow-cathode arc discharge, length 0.8 m, initial diameter 0.01 m served as a starting plasma. Data have been taken in various gases (H_2, He, Ne, A, and Xe). Plasma densities have been varied between 10^{19} and 2×10^{20} m^{-3}. A magnetic mirror field has been used. The guiding B-field was between 0.3 and 1.6 T in the mirrors. In the investigation the ratio f_{ce}/f_{pe} was changed from 0.05 to 0.8. The electrical field strength has been between 10 and 1000 times the Dreicer run-away field in the course of the heating. The anomalous conductivity for widely different values of the ion mass, the plasma density and the magnetic field are given. The energy dissipations can be deduced from these data. Results on electron and ion energies are presented. The shapes of hydrogen Balmer lines and helium lines have been measured as a function of time. From these observations and from direct measurements of strong e.m.-radiation of the plasma, information on the nature of the plasma turbulence could be derived. Plasma parameters which could be attained by turbulence are limited after 2 μs by heat conduction and particle losses of the plasma to the electrodes. Considerable electron and ion heating occurs ($T_e \sim 10$ keV, $T_i \sim 3$ keV) in a complicated sequence of turbulent regimes. (auth)

14400 DYNAMIC BEHAVIOR OF TURBULENT HEATING OF PLASMAS. Nakagawa, Y. (Osaka City Univ); Tanikawa, M.; Watanabe, K. pp 287-297 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

The dynamic behavior of turbulently heated plasma was studied experimentally in three linear machines by using a particle energy analyzer, spectrometer and ruby laser. Parameters of the plasma were in the ranges $10^{12} \sim 10^{15}$/cm^3 for the density, 3 ~ 17 kG for the strength of the magnetic field and 1 ~ 131 for the mass number of the ions. Special attention was paid to the dependence of ion heating on the kind of ions, strength of the magnetic field and the density of the plasma. Measurement of ion energy distribution by charge-exchange neutrals showed that a bump was observed in the high-energy component when the resistive hump was present in the discharge heating current. In the experiment, in the density of about 10^{14} cm^{-3}, the temperature of the low-energy component became lower as the plasma density increased, while those of the high-energy component did not change. Fluctuation measurement indicated that intense electric potential oscillations with frequencies around 5 MHz appeared in the presence of the resistive hump considered to be responsible for heating and accelerations of ions. The heating of the low-energy component is reasonably explained by a stochastic model, in which ions diffuse in velocity space by the above-mentioned oscillating potential field. The high-energy component is considered to be due to the strong resonant acceleration by this potential. (auth)

14401 TURBULENT HEATING OF PLASMA IN TOROIDAL EXPERIMENTS. Hirose, A.; Amagishi, Y.; Shubaly, M. R.; Skarsgard, H. M.; White, B. F. (Univ. of Sasketchewan, Saskatoon, Canada). pp 299-306 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

Two different methods for turbulent heating of a plasma were investigated in similar toroidal devices. In the first method, a conventional, strong, uniform electric field ($\leq 10^4$ V/m) is inductively applied along a toroidal magnetic field (≤ 0.4 T). Rapid electron and ion heating are observed with heating rates $dT_e/dt = 2 - 5 \times 10^9$ eV/s, $dT_i(He^+)/dt = 5 \times 10^8$ eV/s, $dT_i(Ar^+)/dt = 5 \times 10^7$ eV/s. The maximum energy density achieved is close to 10^{23} eV/m^3, with an electron temperature of several keV, $T_i(He^+) \simeq 0.5$ keV and $T_i(Ar^+) = 50$ kV. The electron and ion heating mechanisms are not closely related. The electron heating or anomalous resistivity is explained by a high-frequency trapped-particle instability, while the ion heating is caused by the ion-acoustic instability. In the second method, a relatively weak ($\leq 10^3$ V/m), non-uniform electric field is applied in the direction of the toroidal magnetic field (≤ 1.2T). The nonuniform electric field is produced by either a rotating or non-rotating transverse magnetic field of dipole configuration. Rapid plasma heating is observed, with maximum temperatures $T_e = 0.5$ keV, and $T_i(Ar^+) = 15$ eV, at plasma densities higher than 10^{19} m^{-3}. The observed effective collision frequency of the electrons is $10^8 - 10^9$ s^{-1} and is relatively independent of the field applied, while the ion heating only takes place above a critical transverse field (or corresponding toroidal E-field). It has been found that the rms-electron drift velocity is higher than the critical velocity for growing ion acoustic waves when the ion heating occurs. The origin of the anomalous resistivity is unknown. (auth)

14402 RADIO-FREQUENCY HEATING OF LARGE THERMONUCLEAR TORI. Messiaen, A. M.; Vandenplas, P. E. M. (Laboratoire de Physique des Plasmas, Brussels). pp 319-332 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

A bounded-plasma study is made of the relative merits of various additional rf heating methods for large thermonuclear tori. Total coil loading or surface impedance due to rf power absorption by the plasma and outer wall is computed for some practical cases of both coil and waveguide excitation. Special emphasis is placed on the bounded-plasma effects in the whole frequency range from $\omega \ll \omega_{ci}$ up to $\omega > \omega_{LH}$. In particular, a new method consisting of combining the large increase of the rf field strength inside the plasma due to a magnetosonic resonance of the toroidal cavity with the strong collisionless damping of this high field resulting from electron TTMP, i.e. $\omega \sim |k_{||}|V_e|$ ($k_{||}$ is the wave vector along the axis of the torus and V_e the electron thermal velocity) is advocated. This method is compared to ion TTMP and to ion cyclotron resonance heating combined with a bounded resonance. The existence of coaxial modes of the partially plasma-filled toroidal cavity in the vicinity of the lower hybrid resonance is also discussed. (auth)

14403 HEATING, RELAXATION, AND STABILITY OF COLLISIONLESS HIGH-β-PLASMA IN STRAIGHT THETA-PINCHES. Bogen, P.; Dietz, K. J.; Hintz, E.; Hoethker, K.; Lie, Y. T.; Pospieszczyk, A. (Kernforschungsanlage, Juelich, Ger.). pp 349-363 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

Plasma dynamics and plasma heating are studied in a theta-pinch of 80 cm length at initial densities 10^{12} cm$^{-3} < n_{e1} < 3 \times 10^{13}$ cm^{-3} and with azimuthal electric fields E_p up to 750 V·cm^{-1}. Experimental results on scaling of ion temperature, compression ratio and β wit n_{e1} and E_p are presented. The time dependence of the radial plasma flow is observed and discussed. Special attention is given to an experimental investigation of the current-carrying sheath. Extensive measurements allow a rather detailed description of the turbulent plasma state in the sheath; results are compared with theoretical predictions about ion sound turbulence. Ion dynamics near the axis and the development of pressure equilibrium are investigated. Preliminary results on a theta-pinch of 7 m length, in particular on ion temperature, compression ratio, and β-value are reported. Temporal development of β-value and particle density is studied during the quasi-stationary phase, and the effect of neutral particles is discussed. (auth)

14404 TURBULENTLY HEATED HIGH-VOLTAGE THETA PINCH. Oktay, E.; Desilva, A. W.; Liewer, P. C.; Chen, Y. G.; Griem, H. R.; Hess, R.; Krall, N. A. (Univ. of Maryland, College Park). pp 365-371 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381-(Vol.3); CONF-741105-P3.

The heating of a plasma in a fast theta pinch is described in experiment and numerical simulation. The initial plasma parameters are n_0 equals 3×10^{12} to 3×10^{13} cm^{-3}, T_0 less than 1 eV, and B_0 equals +- 175 G. A shock-like disturbance created by a fast current pulse heats and compresses the plasma. Heating is attributed principally to drift instabilities, namely the Buneman two-stream, the modified two-stream and the ion sound instabilities. Experimental evidence is presented for heating of electrons to approximately 10 keV and ions to temperatures from 3 to tens of keV, depending upon initial conditions. Strongest heating and compression is seen at the lowest densities with antiparallel orientation of bias and pulse magnetic fields. Evidence of turbulent fields is seen, as well as indication of rapid heat loss out the ends of the tube. A numerical model describes the implosion using a a two-fluid code with transport modified by local turbulent fields. These are in turn computed from linear and quasi-linear theory. Model and experiment show agreement in overall dynamical behavior but fail to agree in details of electron and ion heating and sheath thickness. (auth)

14405 IMPLOSION HEATING STUDIES IN THE SCYLLA 1B, IMPLOSION HEATING, AND STAGED THETA-PINCH EXPERIMENTS. Gribble, R. F.; Hammel, J. E.; Henins, I. (Los Alamos Scientific Lab., NM). pp 381-388 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381-(Vol.3); CONF-741105-P3.

Three experiments designed to study various aspects of implosion heating in the plasma density range (10^{14} to 10^{16} cm^{-3}) used in present theta pinches are described. Initial plasma studies show that, provided a sufficiently high pre-ionization level (greater than 10^{14} cm^{-3}) is achieved, plasma behavior is qualitatively the same over a range of two in initial magnetic field rise and a range of four in initial gas fill. The implosion phase is characterized by rapid changes in magnetic-field diffusion rates, the plasma resistivity decreasing rapidly with time. During the implosion some of the plasma density observed is moving ahead of the magnetic piston. Magnetic-field gradients occur in the region outside the area of measurable plasma density implying the presence of hot, low-density plasma in this region. In experiments where the external magnetic field decreases before the maximum compression of the plasma column, secondary breakdown occurs at the discharge tube wall which slows the rate at which magnetic flux diffuses out of the discharge tube. (auth)

14406 RAPID THETA-COMPRESSION HEATING OF A PLASMA OBTAINED BY COLLISION OF PLASMA STREAMS. Ito, H.; Goto, S.; Kishimoto, H.; Satomi, N.; Ushio, T.; Uyama, T. (Osaka Univ.). pp 389-395 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

Extremely-high-temperature plasma is obtained by rapid theta compression of a plasma produced by the encounter of two deuterium plasma streams ejected from two theta-pinch guns situated opposite each other. Both ions and electrons are heated up to nearly the same temperature with almost the same heating rate for initial plasmas with densities of 8×10^{13} to 2.9×10^{14} electrons·cm^{-3}, electron temperatures of 1 to 12 eV and ion temperatures of 5 to 95 eV. Maximum temperatures are 2.5 to 3.5 keV for electrons and 2.2 to 4.0 keV for ions. The ion temperatures measured from Doppler profiles of CIII and CV lines emitted by carbon ions in the plasma are nearly equal to those estimated from the neutron yield. It is also found that ions always start having two-temperature distributions after the compression field attains its maximum value of 25 kG. The heating process seems to be divided into more than two stages, where the observed maximum heating rate is 20 eV·ns^{-1}. Under experimental considerations, the initial plasma is found to be in an expanding state, owing to the continuous inflow of plasma streams. On the basis of this behavior of the initial plasma, a simple one-dimensional particle model is presented for the ion heating. A theoretical formula, which fits the time history of the ion temperature, roughly explains the time behavior of the magnetic-field profiles obtained by a magnetic probe. (auth)

14407 RECENT RESULTS ON HBTX I: CONFINEMENT AND STABILITY OF HIGH-BETA PLASMA IN A REVERSED-FIELD PINCH. Butt, E. P. (Culham Lab., Oxon, Eng.); Gowers, C. W.; Gribble, R. F. pp 417-429 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

A theoretical and experimental study of the RFP is described. The experiments are mostly carried out on HBTX I (R/a = 100/6.5 cm, $\bar{I}$ = 40–200 kA rising in some microseconds, T_{max} = 10–110 eV) in which a driven reversed field is applied and the configuration is controlled by fast programming. Theoretically, for stable RFP-distributions of the type observed, the toroidal correction to classical diffusion is less than 10% and trapped-particle effects can be unimportant. A new 2D-code (MINTOK) is described. A comparison has been made between observations and the predictions of resistive MHD-theory, now including viscosity and ion thermal conduction, computed for experimental distributions. Theory shows that stability is possible with $\beta \sim 30\%$ for all S with conducting walls not too far removed from the position for ideal MHD-stability; viscosity and ion thermal conduction damp both ideal and resistive modes at low S, while finite-Larmor-radius effects are important at high S (S is the magnetic Reynolds number). Viscous damping can explain the absence of modes at low currents which are observed at high currents, and localized modes of the MHD Suydam type are not found experimentally or theoretically. The resistive-tearing (kink) mode has been identified experimentally and suppressed by reducing the compression ratio in accord with theory. Experimentally, at low currents, the plasma decays without instability in about 35 μs and its behavior during the setting-up and decay phases is classical. At high currents, instabilities are observed which are believed to be pressure-driven resistive modes because $\beta_\theta \gtrsim 0.6$ is too high for stability. This instability leads to substantial cooling but does not destroy the plasma and at later times the plasma tends to become quiescent and β_θ rises again. Detailed studies on HBTX I and Zeta show that the plasma by itself (without programming) generates an RFP configuration as predicted theoretically by J. B. Taylor; this "self-reversal" leads to configurations close to high-beta stable ones. (auth)

14408 FUSION DYNAMICS OF LOSSY REACTOR SYSTEMS AND POWER BALANCE IMPLICATIONS. McNally, J. R. Jr.; Clarke, J. F.; Fowler, R. H.; Hiraoka, T.; Sharp, R. D.; Steiner, D. (Oak Ridge National Lab., TN). pp 511-523 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol. 3); CONF-741105-P3.

Nuclear-fusion reactivity calculations are reported for zero-dimensional, magnetically confined, lossy reactor systems after the methodology of Etzweiler, Clarke and Fowler. These systems are radiation-damped, dissipative-trapped-particle-loss-mode-dominated DT-fuelled tokamak reactors. Injection of a mixed energetic neutral beam of D^0 and T^0 at E_0 equals 300 keV heats the plasma to ignition following which a thermal runaway occurs until the increasingly severe dissipative trapped-ion losses lead to a plasma "blow-out" phenomenon. The blow-out process is identified with the use of too high an injection energy. Reduction of the fuel injection energy below the instability value permits steady-state reactor operation at high Q/sub eta/(equals P/sub out//P/sub in/). A steady-state tokamak can operate, in principle, at E_0 equals 25 keV after ignition with E_0 equals 300 keV neutrals with a Q/sub eta/ of 22. The temperature perturbation of such a steady-state reactor leads to a negative temperature coefficient; source perturbations give a positive density coefficient which must be carefully controlled to prevent excessive wall loading; magnetic field perturbations give a positive field coefficient which would permit positive feedback control on the reactivity. The power balance implications are assessed on the following assumptions: (1) The neutral beam injectors have an efficiency of 70 percent. (2) The pulsed magnetic field energy is supplied by a superconducting magnetic-energy storage and transfer system having an efficiency of 90 percent and approximately 80 percent of the pulsed magnetic energy is recovered at the end of each cycle. (3) The efficiency of the thermal conversion system is 40 percent. With these assumptions, a Q/sub eta/ of about 14 is required in order to achieve net power production with an overall plant efficiency of 30 percent. To achieve power break-even, a Q/sub eta/ of about 3 is necessary. (auth)

14409 PARAMETRIC SURVEY FOR THE LINEAR TWO-COMPONENT SYSTEM. Heckrotte, W.; Hiskes, J. R.; Freis, R. P. (Univ. of California, Livermore). pp 557-568 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol. 3); CONF-741105-P3.

A parametric study is presented for the linear, two-component, mirror fusion system in which the interrelationship of the important system parameters is displayed. The distribution function of the high-energy component and related functions are calculated from the Fokker-Planck equation. The functions are conveniently parametrized by the ratio of injection energy to the target electron temperature. The Q-values for the two-component system are found to be increasing functions of the injection energy up to 200 keV and then to exhibit a broad maximum from 200 to 600 keV. The optimum Q values are significantly greater (greater than 2) than for the conventional mirror system. System lengths are derived as a function of the magnetic field, target electron temperature, plasma potential, and alpha-particle heating. For a given Q (or injection energy/electron temperature ratio) the system lengths, which may be long, are balanced against magnetic-field values, which may be large. Effective bounds on several parameters are established. The presence of alpha-particles in the system may result in the development of a deuterium "halo" surrounding the target plasma, which can severely attenuate the incident beam. Accommodation of these "halo" effects necessitates a longer system. (auth)

Plasma Diagnostics

Refer also to abstract 14721.

14410 (CONF-750356–, pp K11-K132) DEDUCTION OF WAVES IN A TURBULENT PLASMA FROM SPECTROSCOPIC OBSERVATIONS. de Kluiver, H.; Rutgers, W. R. (FOM-Inst. voor Plasmafysica, Rijnhuizen, Jutphaas, Netherlands). 1975.

From 2nd international congress on waves and instabilities in plasmas (SICWIP); Innsbruck, Austria (17 Mar 1975).

In second international congress on waves and instabilities in plasmas. Survey lectures.

Calculations for the H_α-line perturbed by strong electric fields are given, and the results are compared with experimental data. Also, the theory and measurements of turbulent helium discharges are discussed. (WHK)

14411 (CONF-751125-118) DATA ACQUISITION FOR PLT. Thompson, P. A. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). 1975. 40p. Dep. NTIS $4.00.

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

DA/PLT, the data acquisition system for the Princeton Large Torus (PLT) fusion research device, consists of a PDP-10 host computer, five satellite PDP-11s connected to the host by a special high-speed interface, miscellaneous other minicomputers and commercially supplied instruments, and much PPPL produced hardware. The software consists of the standard PDP-10 monitor with local modifications and the special systems and applications programs to customize the DA/PLT for the specific job of supporting data acquisition, analysis, display, and archiving, with concurrent off-line analysis, program development, and, in the background, general batch and timesharing. Some details of the over-all architecture are presented, along with a status report of the different PLT experiments being supported. (auth)

14412 (FRNC-TH-558) TRANSMISSION OF A CHAIN OF FABRY-PEROT INTERFEROMETERS. Moghrabi, B. (Lyon-1 Univ., 69 (France)). 1974. 195p. (In French). INIS.

Attempts were made to obtain a spectrometer giving the narrowest bandwidths possible by using several Fabry-Perot interferometers in series. A comparative study showed that for a given number of Fabry-Perot (F. P.) and for a given reflection factor of the plates, it is much more effective to increase the free spectral interval by suitably choosing the ratios of the F. P. orders N(1), N(2), ... N(q), than to try and reduce the band pass width. In the study of each combination the difficulty lay in the exact determination of the position and height of several hundred maxima of the product of several Airy functions. A preliminary study of the suitable ratio of the orders of two F.P.s in series with an interferential filter was carried out by an approximate analog densitometric method, then by a digital calculation. It showed up certain rules, referred to as the "method of forbidden zones". This new method was studied in detail and applied systematically in the case of two F. P.s in series, two F. P.s and a filter in series, then three F. P.s in series. It was extended to chains made up of three F. P.s in series with an interferential filter. The results obtained showed that the bandwidths can be reduced by a factor 900 without any parasitic peak exceeding 0.001 and for a relatively moderate reflection factor (0.90), the chains (1,178, 259, 919) and (1,477, 611, 899) allowing an overall narrowing of the spectrometer bandwidths by factors of 1013 and 1325 respectively with no parasitic peak exceeding 0.001 for the former chain and 0.0013 for the latter. (FR)

14413 (INR-1480/24/PP/B) OBSERVATIONS OF PLASMA DISCHARGE DEVELOPMENT BY MEANS OF INTERFEROMETER

WITH Q-SWITCHED RUBY LASER. Appelt, J.; Czaus, K.; Sadowski, M.; Ugniewski, S. (Institute of Nuclear Research, Warsaw (Poland)). 1973. 32p. (In Polish). INIS.

The main features are given for a laser interferometric system of Mach-Zehnder type which has been designed and built in the High-Temperature Plasma Physics Department of the Institute of Nuclear Research. This system is equipped with a Q-switched ruby laser and an auxiliary cw He-Ne laser. The interferometer described has been used for investigations of a plasma produced by electrical discharges between two hemispherical electrodes. Interferograms are given of various stages of such a discharge, and the results of quantitative analysis of those. (auth)

14414 REPRODUCIBLE CONTROL OF THE VOLTAGE OF LANGMUIR PROBES IN STEADY-STATE AND AFTERGLOW PLASMAS. Wunderer, B. M. (Univ., Munich). J. Phys., E (London); 8: No. 11, 938-942(Nov 1975).

A regulation circuit is described that makes possible very accurate probe measurements by virtually eliminating work function drift and plasma potential fluctuation effects on the probe characteristic. By the use of a reference probe and repeated measurement of the floating potential of the active probe in time intervals that are short compared to the time constant of the work function drift, a voltage scale can be established for the probe with an accuracy and repeatability of a few mV. As an application of the method, the rapid thermalization of the electrons and the appearance of the fundamental diffusion mode in a hydrogen afterglow are shown. (auth)

14415 ARGON PLASMA PRODUCED BY A LOW ENERGY COAXIAL ACCELERATOR. Ionescu-Bujor, T.; Iordanescu, S.; Mandache, N.; Zaharescu, M.; Zoita, A.; Zoita, V. (Inst. of Physics, Bucharest). Rev. Roum. Phys.; 20: No. 5, 453-458(1975).

A transient argon plasma was produced by a coaxial accelerator. The line and continuum emissions recorded by means of time-resolved spectroscopic measurements were used to determine the electron density and temperature. The experimental results indicate that the argon plasma is in partial LTE. (auth)

14416 LASER-DOPPLER ANEMOMETRY WITH A 5mW LASER, IN ARGON PLASMA FLOW. Gouesbet, G. (Institut Scientific de Haute-Normandie, 76-Rouen (France)). C. R. Hebd. Seances Acad. Sci., Ser. A, B; 280: No. 19, 597-600(21 May 1975). (In French)

An interferential laser-Doppler anemometer, with a 5mW He-Ne laser, has been used to measure mean velocity in an atmospheric HF argon plasma flow. (FR)

14417 THE USE OF LASER BEAMS FOR PLASMA DIAGNOSTICS. Gex, J. P.; Jolas, A.; Launspach, J.; Schirmann, D. (CEA Centre d'Etudes de Limeil, 94-Villeneuve-Saint-Georges (France)). Bull. Inf. Sci. Tech. (Paris); No. 204, 47-60(Jun 1975). (In French)

The optical properties of lasers allow them to be a promising source for plasma diagnosis. The Q-switched lasers provide the opportunity to make observations in a very short time interval down to a few picoseconds. The laser space and time coherence properties allow interferometric measurements of plasma electron densities. Thus in the experiments of laser-matter interactions, the radiation obtained by frequency conversion of the Nd: glass laser emission is used for density measurements (up to 10^{20} cm^{-3}) in small scale plasmas ($\simeq$ 1mm). Owing to the monochromaticity and high intensity of the Q-switched laser radiation, density fluctuations and microscopic instabilities of the plasma can be studied by Thompson scattering measurements. Finally, some statistically isotropic media become birefringent under the action of the strong electrical field of the laser beam radiation. This effect can be used for laser pulse duration measurements in a range not exceeding a few picoseconds. (FR)

14418 ANGULAR PHASE DISTRIBUTION OF THE FIELD OF AN ELECTRIC DIPOLE IN A HOT MAGNETOPLASMA. Singh, N. (n Inst. of Tech. Kanpur, India). IEEE Trans. Antennas Propag.; AP-23: No. 4, 592-594(Jul 1975).

The angular distribution of the phase of the fields of an electric dipole with and without a sheath in a hot magnetoplasma is calculated. Like the amplitude distribution of the field, the phase distribution can also be used for estimating the electron temperature (auth)

14419 PERFORMANCE OF A FEEDBACK CONTROLLED ELECTROSTATIC ENERGY ANALYZER FOR USE WITH AN ION BEAM PROBE DIAGNOSTIC SYSTEM. Reinovsky, R. E.; Glowienka, J. C.; Jennings, W. C.; Hickok, R. L. (Rensselaer Polytechnic Inst., Troy, NY). IEEE (Inst. Electr. Electron. Eng.) Trans. Plasma Sci.; PS-3: No. 4, 194-200(Dec 1975).

The performance of a feedback controlled electrostatic energy analyzer has been investigated for use as the basic detection mechanism in an ion beam probe plasma diagnostic system. This system provides the only direct, spatially resolved measurement of plasma space potential. The principles involved in analyzer operation are presented, leading to an analyzer system with a design entrance angle of 33^0. The voltage correction function which results when the probing beam is swept across the plasma has been measured experimentally and is in excellent agreement with theoretical predictions. The measured amplitude and phase response of the system show that the entire analyzer/detector system may be modeled as a linear feedback system. Finally, a dual beam technique is described for making absolute space potential measurements and is substantiated with experimental data from an arc plasma using a Rb-K combination. (auth)

14420 ANALYSIS OF THE GEOMETRY, DYNAMICS, AND MAGNETIC STRUCTURE OF A PLASMA PINCH BY THE LASER INTERFEROMETRY METHOD. Filippov, N. V.; Ivanov, V. D.; Moiseeva, M. P.; Sukhareva, N. K. (Inst. of Atomic Energy, Moscow). pp 123-131 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975). (In Russian).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

The authors investigate the dynamics of the final stage in the compression of a plasma pinch by the differential laser interferometry method and on the basis of the Faraday rotation of the polarization plane. The distributions of the electron density and the structures of the magnetic fields in the plasma pinch are ascertained. The maximum densities on the pinch axis are 2×10^{18} cm^{-3}, the skin layer thickness in the first compression is 1.5 mm and the characteristic stability time is 200 ns. (auth)

14421 EXPERIMENTS ON THE APPLICATION OF LASER SELECTIVE EXCITATION SPECTROSCOPY TO THE DIAGNOSTICS OF A POTASSIUM PLASMA. Rodrigo, A. B. Toronto; Toronto Univ. (1972). 120p. National Library of Canada, Ottawa.

Thesis (Ph. D.).

A thermally tuned Q-switched ruby laser of moderate power, with emission wavelength at 6939A, has been used to selectively excite the $4^2P_{\frac{1}{2}}-6^2S_{\frac{1}{2}}$ transition in the atoms of a pure potassium plasma of low degree of ionization produced in a hot cathode diode. A pulse of intensified spontaneous emission has been observed at 6939A, 6911A and at a number of other wavelengths. The possibility of using this type of interaction for the purpose of diagnosing the plasma has been studied experimentally. The results obtained indicate that using an adequately tailored laser pulse it should be possible to measure the electron density and the excitation temperature in a potassium plasma in the range $10^{12}-10^{14}$ cm^{-3} and 2000-3500°K respectively. (auth)

14422 MICROWAVE DIAGNOSTICS OF A STRONG ARC DISCHARGE PLASMA IN SF_6. Musil, J.; Zacek, F. (Ceskoslovenska Akademie Ved, Prague. Ustav Fyziky Plazmatu). Z. Naturforsch., A; 30: No. 8, 947-950(Aug 1975).

3 figs.; 1 ref.

The paper deals with the microwave free-space diagnostics of high collision arc discharge plasmas. It is found that information about the electron density N and the collision frequency ν in such a plasma can be obtained from the energy transmitted through the plasma by an electromagnetic wave. The phase of the electromagnetic wave cannot be used since it is almost the same as that of a wave passing through vacuum. These basic concepts are verified experimentally at a frequency of 37.5 GHz. It is shown how the time dependence of the electron density in a plasma with constant and with time variable collision frequency may be evaluated. (DE)

14423 COMPARISON OF THE ELECTRON TEMPERATURES AND DENSITIES MEASURED FOR A PLASMA GAS AND FOR ELEMENTS EXCITED IN A HIGH-FREQUENCY PLASMA. Mermet, J. M. (Institut National des Sciences Appliquees, Villeurbanne, France). Spectrochim. Acta, Part B; 30B: No. 10-11, 383-396(1975). (In French)

In a high frequency induced plasma, temperatures and electron densities as derived from spectroscopic measurements have been compared, using spectral lines from the plasma (argon) and from elements injected as aerosols. The excitation temperatures thus measured are comparable. The measured electron densities do not link up with the excitation temperature, if SAHA equilibrium is assumed. This observation could indicate that L.T.E. does not prevail under the conditions of the experiments. (auth)

14424 SOME CONSIDERATIONS ON THE MICROWAVE ELECTRODELESS DISCHARGE. Plasma Diagnostics in Argon, Helium,

or Nitrogen Atmospheres. Avni, R.; Winefordner, J. D. (Univ. of Florida, Gainesville). Spectrochim. Acta, Part B; 30B: No. 8, 281-303(Aug 1975).

Plasma diagnostics of several microwave plasmas are determined by making electrical (with double floating probes) and optical measurements in pure Ar, He or N_2 plasmas, and also in Ar plasmas containing various metals, i.e., Cs, Tl or Zn; plasma parameters, such as electric field (E), electron (j_e) and ion (j_i) current densities, electron density (n_e), electron temperature (T_e), electron conductivity (σ_e), ion density (n_i), electron mean free path (λ_e), electron (μ_e) and ion (μ_i) mobilities and electron [$(v_e)_{drift}$] and ion [$(v_i)_{drift}$] velocities are either directly measured or calculated. The reversal temperature (T_r) of excited (0.96 eV lower level) thallium atoms is measured, and the steady-state conditions of the plasma are analyzed by the energy balance equation. The experimental measurements indicate that the electric field strength E decreases as the space charge decreases (ionization extent). Although the plasma appears to be under steady-state conditions, it is not under local thermo-dynamic equilibrium conditions, i.e., $T_e > T_r$. In addition, the measurements indicate that there is a deficiency of electrons in the plasma ($n_e < n_i$), probably due to electron affinity processes; and the plasma has a small positive space charge. (auth)

14425 INEXPENSIVE COMPUTERIZED LASER AND PLASMA DIAGNOSTIC SYSTEM. Szichman, H.; Ramigolski, B. (Israel Atomic Energy Commission, Yavne). J. Phys., E (London); 8: No. 9, 742-744(Sep 1975).

A minimal computerized laser and plasma diagnostic system, suitable for small and medium laser installations, is presented. This system is now being operated successfully; typical diagnostic sheets are given for illustration. (auth)

Plasma Kinetics (General)

14426 (CONF-750356, pp F1-F39) MATHEMATICAL MODELS OF PLASMA AND HYDRODYNAMICS PROBLEMS. Feix, M. R. (Univ., Orleans, France). 1975.

From 2nd international congress on waves and instabilities in plasmas (SICWIP); Innsbruck, Austria (17 Mar 1975).

In second international congress on waves and instabilities in plasmas. Survey lectures.

Application to the Navier Stokes equation of models worked out in plasma physics and especially use of the so called "Multiple Water Bag" model to the study of stability of vorticity distributions is discussed. Analytical and numerical efforts to understand the properties of the different models are described. Some discretization processes differing by the level at which the unavoidable discretization of any numerical model is introduced are compared. Also, some new physical results are presented concerning the stability properties of steady state periodic solutions of the Vlasov equation. (WHK)

14427 (CONF-750356, pp Ha1-Ha12) EXPERIMENTS ON PLASMA TURBULENCE INDUCED BY STRONG, STEADY ELECTRIC FIELDS. Hamberger, S. M. (Culham Lab., Abingdon, Eng.). 1975.

From 2nd international congress on waves and instabilities in plasmas (SICWIP); Innsbruck, Austria (17 Mar 1975).

In second internation congress on waves and instabilities in plasmas. Survey lectures.

The effect of applying a strong electric field to collisionless plasma is studied. In particular, what some simple ideas and prejudices lead us to expect to happen, what computer simulation experiments tell us ought to happen, and what actually does happen in two laboratory experiments which have been designed to allow the relevant instability and turbulent processes to occur unobstructed are compared. (WHK)

14428 (CONF-750356-, pp T1-T70) THERMAL FLUCTUATIONS IN PLASMAS. Thompson, W. B. (Univ. of California, San Diego, La Jolla). 1975.

From 2nd international congress on waves and instabilities in plasmas (SICWIP); Innsbruck, Austria (17 Mar 1975).

In second international congress on waves and instabilities in plasmas. Survey lectures.

A survey is presented of the fluctuations to be expected in plasmas. A resume of the familiar test particle results is followed by a derivation of the wave transport equation and an examination of the effects of plasma nonuniformity on the fluctuation spectrum. The effect of a magnetic field is then examined, where, in addition to the modes of a uniform plasma, drift waves also appear. Observable effects on fluctuations are discussed and the scattering cross section form factor evaluated. (auth)

14429 (TRITA-EPP-75-06) QUASI-STEADY PLASMAS BEING PERMEABLE TO NEUTRAL GAS. Lehnert, B. (Kungliga Tekniska Hoegskolan, Stockholm (Sweden). Institutionen foer Plasmafysik med Fusionsforskning). 31 Mar 1975. 64p. Dep. NTIS (US Sales Only) $4.50.

Neutral gas which penetrates into a hot magnetically confined plasma body of the characteristic dimension L_b, density n_b and temperature T consists mainly of a slow and a fast component, of densities n_{ns}, n_{nf} and temperatures $T_{ns} \ll T$, $T_{nf} \simeq T$, respectively. The quasi-steady neutral gas distribution within the plasma is characterized by the corresponding penetration lengths $L_{ns} = 1/\sigma_{cs}n$ and $L_{nf} = 1/\sigma_{cf}n$, where $1/\sigma_{cf} \simeq 100/\sigma_{cs} \simeq 5 \times 10^{18} m^{-2}$ for light gases like hydrogen and helium in the range $T = 10^6$ to 10^7 K. Hot plasmas can thus be divided into two main classes, i.e., permeable plasmas for which $L_{nf} \gtrsim L_b$ and impermeable plasmas for which $L_{nf} \ll L_b$. Further, permeable plasmas can be divided into the subclasses of dilute plasmas where $L_{ns} \gtrsim L_b$ and non-dilute plasmas where $L_{ns} \ll 1$. All these classes have different equilibrium and stability properties. A detailed study is given of permeable plasmas, in addition to earlier investigations on the impermeable plasma state. (auth)

14430 (TRITA-EPP-75-12) INTERACTION OF A PLASMA STREAM WITH SOLID BODIES. Kristoferson, L. (Kungliga Tekniska Hoegskolan, Stockholm (Sweden). Institutionen foer Plasmafysik med Fusionsforskning). May 1975. 55p. Dep. NTIS (US Sales Only) $4.50.

Results are presented from a laboratory experiment where a proton plasma stream is colliding with different solid obstacles. The light phenomena of the interaction are observed spectroscopically, and the density structure of the clouds built up around the obstacles are studied by laser interferometer technique. The density of the clouds are very different for the different obstacles, depending on the efficiencies for the various erosion mechanisms present on the obstacle surfaces. The light of the interaction shows that impurity ions in the vacuum vessel are rapidly ionized to high levels. This requires the original electron temperature of the plasma stream to be raised by a factor of five in the region near the surface. Besides the impurity ions, which are common to all obstacles, ions and atoms specific to each target are released by sputtering and other erosion mechanisms. The emission velocities of those particles can be measured by time-resolved spectroscopy. The plasma cloud around the obstacles have a complicated structure. Molecules, neutrals and ions from the target bulk material are observed near the surface. The emission from the outer parts of the cloud are dominated by impurity ions. (auth)

14431 (TRITA-EPP-75-13) PLASMA–NEUTRAL GAS BOUNDARY LAYERS. Lehnert, B. (Kungliga Tekniska Hoegskolan, Stockholm (Sweden). Institutionen foer Plasmafysik med Fusionsforskning). 23 May 1975. 27p. Dep. NTIS (US Sales Only) $4.00.

The plasma–neutral gas balance is considered in the partially ionized transition region situated between a fully ionized magnetically confined plasma and an adjacent neutral gas cloud. A well-defined boundary layer can develop between the plasma and the neutral gas, but only within certain ranges of the relevant parameters such as the plasma density and the magnetic field strength. Consequently, such layers are expected to appear in the atmospheres of normal and magnetic variable stars and in other more dense cosmic clouds of matter, as well as in impermeable laboratory plasmas. On the other hand, sharply defined boundary layers are unlikely to appear in the low-density regions of interstellar and interplanetary space where the plasma becomes permeable to neutral gas and the partially ionized transition region has a minimum depth of the order of $5 \times 10^{18}/n_b$ m where n_b is the corresponding characteristic plasma density. (auth)

14432 (TRITA-EPP-75-14) ION–ION COLLISIONS AND ELEMENT SEPARATION EFFECTS IN THE BOUNDARY REGION OF A PLASMA SURROUNDED BY NEUTRAL GAS. Bonnevier, G. (Kungliga Tekniska Hoegskolan, Stockholm (Sweden). Institutionen foer Plasmafysik med Fusionsforsknig). May 1975. 22p. Dep. NTIS (US Sales Only) $3.50.

In the boundary region between a plasma and neutral gas, the temperature is low, some thousand degrees. Then the Coulomb-cross section is large compared with other collision cross sections. The influence of ion-ion collisions in the boundary region is discussed. In particular a simple formula is derived for the separation between different kinds of constituents. This separation depends on different collision cross sections for diffusion and seems to be especially large when resonant charge exchange collisions are involved. These diffusive processes of importance in impermeable plasmas are also compared with separation processes due to a difference in ionization potential, which is known to occur in permeable plasmas. Different isotopes have the same ionization potential and the same charge exchange cross sections. The separation processes described above are therefore likely to give element but not isotope separation. (auth)

14433 PRODUCTION AND ABUNDANCE MEASUREMENTS OF MULTICHARGED XENON IONS IN ECR PRODUCED PLASMAS. Briand, P.; Geller, R., Jacquot, B.; Jacquot, C.; Theiss, A. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de la Physique du Plasma et de la Fusion Controlee). Nucl. Instrum. Methods; 127: No. 3, 441-443(15 Aug 1975).

A description is given of a machine which produces multiply charged ions in a plasma created by a series of electron resonances (ECR). Plasma parameters and abundances of xenon ions extracted from the plasma are presented. (NL)

14434 PROCESSES NEAR THE PLASMA-METAL BOUNDARY UNDER DISRUPTIVE CONDITIONS IN PLASMA FOCUS SYSTEMS. Filippov, N. V. (Inst. of Atomic Energy, Moscow); Bazdenkov, S. V.; Belyaeva, I. F.; Bezbatchenko, V. A.; Gureev, K. G.; Filippova, T. I.; Imshennik, V. S.; Kazhdan, Ya. M.; Pliner, L. A. pp 133-147 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975). (In Russian).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

A complex of interrelated phenomena occurring under disruptive conditions is considered: interaction of the plasma with the metal, acceleration of the current sheath, formation of a strong electron flux, generation of hard x-rays, appearance of high-energy deuterons and blistering of the back of the anode. The time and space characteristics of the bremsstrahlung, the integrated energy spectra of the high-energy component of the deuterons and of the hard x-rays, and their dependence on the discharge parameters are determined. With the method used for treating the hard x-ray spectra it is possible to reconstruct the spectrum of the primary electrons of the flux. From metallographic investigations based on structural changes in the anode material, an estimate is made of the pulsed electron beam pressure on the anode bearing in mind that the entire discharge current is transmitted as a directed electron flux. On the basis of the data presented, the authors propose a model according to which formation of the electron beam and hence acceleration of the electrons and deuterons occur in an electric field developing in a disruption of the current caused by a thin layer of metal vapor above the anode surface. (auth)

14435 LARGE AMPLITUDE MAGNETIC PULSE PENETRATION INTO CYLINDRICAL PLASMA. Tsui, K. H. Austin, TX; Univ. of Texas (1975). 109p. University Microfilms Order No. 75-16,752.

Thesis (Ph. D.).

Experiments have shown anomalous penetration of large amplitude magnetic pulse in a fast theta pinch that could not be explained by linear theory. A coherent approach based on a set of non-linear Magnetohydrodynamic and Maxwell's equations has been used to study this phenomena. To include the cylindrical convergence effect, the equations are written in cylindrical coordinates. The magnetic field, electron density and other plasma variables are functions of radius r and time t. Quasi-neutrality condition is assumed. The equations are then transformed into Lagrangian coordinates and further reduced. This leads to two non-linear coupled partial differential equations of magnetic field and electron density. They are solved subject to initial and boundary conditions by numerical methods. The code is so written for arbitrary initial density profile and with or without static magnetic field. The results, which show that the velocity of penetration scales like Alfven velocity, agree with observed experimental data of the University of Texas at Austin very well. This suggests an alternative explanation other than the turbulent and Helicon wave approaches of the anomalous penetration. (Diss. Abstr. Int., B)

14436 FOCUSING OF AN INTENSE RELATIVISTIC ELECTRON BEAM BY A HOLLOW CONICAL LASER BEAM. Winterberg, F. (Nevada Univ., Reno (USA). Desert Research Inst.). Z. Naturforsch., A; 30: No. 8, 976-980(Aug 1975).

From international conference on energy storage, compression and switching; Torino-Asti, Italy (5 Nov 1974). 2 figs.; 11 refs.

Estimates suggest that the nonlinear transverse radiation pressure produced within a plasma by a convergent annular high power laser beam may lead to the focusing of an intense relativistic electron beam down to a radius of approximately 10^{-4} cm. The transverse radiation pressure results from the dielectric property of a plasma in conjunction with the phenomena of the self-focusing of intense laser light. The tightly focused electron beams would make possible the release of thermonuclear energy by micro-explosions. (DE)

14437 RESONANCE CONES IN A WARM PLASMA FOR FINITE MAGNETIC FIELDS. Burrell, K.H. (California Institute of Technology, Pasadena, California 91125). Phys. Fluids 18: No. 12, 1716-1733 (Dec 1975).

The resonance cone structure excited by a localized source is studied theoretically and experimentally for a warm plasma with a finite, uniform magnetic field. The electrostatic Green's function is evaluated by asymptotically expanding it in the limit where the observation point is far from the source. Results are obtained that are valid for all angles and for all frequencies below the upper hybrid. The theory predicts the functional dependence of the angular location of the main resonance cone peak and the angular spacing between interference peaks on the physical parameters. Experimental parameter studies were made to check the predicted functional dependence; it was found to produce a good fit to the data. Both density and temperature can be found from these measurements; thus, resonance cone measurements are a useful diagnostic technique in any magnetoplasma in which antennas can be

14438 MOTION OF A PLASMA COLUMN IN A PERTURBING MAGNETIC FIELD. Miller, G. (Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87545). Phys. Fluids 18: No. 12, 1704-1709 (Dec 1975).

The motion of a plasma column acted upon by a small external magnetic field is calculated using the sharp-boundary ideal magnetohydrodynamic model. The natural oscillation frequencies of the system are obtained. For the theta pinch, simple approximate formulas useful in considering feedback and dynamic stabilization schemes are derived. (auth)

14439 MACROSCOPIC PROPERTIES OF THE INVERSE THETA-PINCH EFFECT. Kondoh, Y.; Itoh, K. (Department of Electronics, Gunma University, Kiryu, Gunma, Japan); Nagao, S. Phys. Fluids 18: No. 11, 1574-1579 (Nov 1975).

Macroscopic properties of the inverse theta pinch are investigated. It is found that the second and succeeding explosions of this pinch begin soon after each peak of the oscillatory coil current, whereas the first explosion begins at the first increase in the current. It is also found that the velocity v of this pinch depends on the mass density ρ_0 of the gas and on the peak coil current density i_m approximately as $v \propto \rho_0^{-1/4}\, i_m^{1/2}$ for the first explosion, and as $v \propto \rho_0^{-1/6}\, i_m^{1/3}$ for the second and succeeding explosions. These new experimental observations are analyzed theoretically. (auth)

14440 TWO-DIMENSIONAL ION EFFECTS IN RELATIVISTIC DIODES. Poukey, J.W. (Plasma Theory Division, Sandia Laboratories, Albuquerque, New Mexico 87115). J. Vac. Sci. Technol. 12: No. 6, 1214-1217 (Nov 1975).

In relativistic diodes, ions are emitted from the anode plasma. The effects and properties of these ions are studied via a two-dimensional particle-simulation code. The space charge of these ions enhances the electron emission, and this additional current (including that of the ions themselves) aids in obtaining superpinched electron beams for use in pellet fusion studies. (auth)

14441 SPACE-TIME STRUCTURE OF ION BEAM-PLASMA TURBULENCE. Doveil, F.; Grésillon, D. (Groupe de Recherche du Centre National de la Recherche Scientifique, Laboratoire de Physique des Milieux Ionisés, Ecole Polytechnique, 91120 Palaiseau, France). Phys. Fluids 18: No. 12, 1756-1761 (Dec 1975).

The turbulence excited by an ion beam penetrating an unmagnetized plasma is investigated. One-dimensional linear kinetic theory predicts the ion acoustic mode to be driven unstable when the beam velocity v_b ranges from c_s to $2c_s$. Numerical calculations are reported for the three dimensional problem, in which attention is given to unstable waves. The direction of propagation, the phase velocities, and the growth rate contours in the $(k_\parallel, k_\perp)$ plane, are given as a function of v_b. This in[illegible]bility is created in a double plasma device, and investigated by m[illegible]ns of space and time correlations. Turbulence is excited, consisting of modes propagating at a phase velocity which agrees with theory. As v_b increases, an abrupt transition from one-dimensional to three-dimensional structure occurs as expected. (auth)

Plasma Kinetics (Experimental)

14442 (INIS-mf-1855, pp 71-97) PLASMA BEHAVIOUR IN MAGNETIC FIELD CONFIGURATIONS CREATED BY PERMANENT MAGNETS. Goede, A. P. H.; Brakenhoff, H. J.; Massmann, P. 16 Apr 1975.

This has been published in Plasma Phys., v. 15 (1973) p. 977; 13 figs., 18 refs., 2 tables.

In ion beam plasma interaction. The production of a quiescent plasma.

A plasma can be stabilized effectively in an average minimum B type magnetic field created with the help of permanent magnets. Measurements of the spatial distribution of noise level, density and electron temperature were done in steady state. These results are compared with analogous measurements in two other types of field configuration: a magnetic mirror field and a Joffe-type minimum B-field, the latter obtained also with application of permanent magnets. In the second part of this chapter, the confinement properties of the three field configura-

tions are measured and compared. A theoretical model to interpret the results is discussed. (auth)

14443 PRODUCTION OF MULTICHARGED IONS OF NEON AND KRYPTON AND MEASUREMENT OF THEIR ABUNDANCE. Briand, P.; Dupas, L.; Geller, R.; Gormezano, C.; Jacquot, B.; Jacquot, C.; Theiss, A. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Grenoble, 38 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Service d'Ionique Generale). C. R. Hebd. Seances Acad. Sci., Ser. A, B; 280: No. 19, 593-596(21 May 1975). (In French)

A plasma device based on ECR heating is described. Highly stripped neon and krypton ions (up to Ne^{8+} and Kr^{12+}) are produced. These multicharged ions are extracted in a quasi-continuous regime. Their relative abundance is measured. (FR)

14444 CONDITION FOR INJECTION OF INTENSE RELATIVISTIC ELECTRON BEAMS INTO A Z PINCH. Roberts, T. G. (U. S. Army Missile Command, Redstone Arsenal, AL). IEEE Trans. Plasma Sci.; PS-3: No. 4, 216-225(Dec 1975).

Intense relativistic electron beams have been injected into the plasma of a Z pinch at various times during the formation of the plasma column. If the diameter of the plasma column exceeded a certain value, these beams were found to propagate with a high transport efficiency when injected either into the collapsing current sheet of the Z pinch or into the expanding plasma column after its diameter had reached a minimum. However, when the diameter of the plasma column is smaller than this critical value, the relativistic electron beam does not propagate. Instead, it continues to diverge until it strikes the glass wall of the Z pinch tube. (auth)

14445 PLASMA TURBULENCE MEASUREMENTS FROM FORBIDDEN TRANSITIONS IN ARGON AND NEON. Turner, J.M. (Department of Physics, Morehouse College, Atlanta, Georgia 30314). Phys. Fluids 18: No. 12, 1824-1825 (Dec 1975).

Possible forbidden transitions are suggested as sources of satellites for the study of plasma turbulence. These transitions are in argon and neon and have some advantages over previously used helium lines. (auth)

14446 RELATIVISTIC ELECTRON DYNAMICS IN A CUSPED MAGNETIC FIELD WITH A DOWNSTREAM DRIFT REGION. Destler, W.W.; Misra, P.K.; Rhee, M.J. (University of Maryland, College Park, Maryland 20742). Phys. Fluids 18: No. 12, 1820-1822 (Dec 1975).

Studies are reported of the motion of relativistic electrons injected first through a narrow magnetic cusp and then into a downstream region in which the particle motion is assumed to be adiabatic. Experiments performed to check the theory are also presented. (auth)

14447 PLASMA EXPERIMENTS IN THE SCYLLAC TOROIDAL THETA PINCH. Cantrell, E. L.; Ellis, W. R.; Harris, H. W. (Los Alamos Scientific Lab., NM). pp 13-23 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381-(Vol.3); CONF-741105-P3.

Experiments on plasma equilibrium and stability in the Scyllac full torus, and in earlier 5-m and 8-m toroidal sectors, are reported. In all these experiments, the outward toroidal drift was compensated by a combination of l equals a helical and l equals 0 bumpy fields generated by shaping the inner surface of the compression coil or by driven l equals 1 windings. Time-resolved measurements of the gross plasma column motion, plasma radius, excluded flux, external magnetic field, plasma density, electron and ion temperatures, and plasma beta have been made. Preliminary results show that the plasma behavior in the 8-m sector and the full torus (both with major radius R equals 4 m) is qualitatively the same, with a well-defined, theta-pinch-type plasma column being formed in both cases. No plasma shredding or evidence of microinstabilities is seen, and no m greater than or equal to 2 modes have been observed. The plasma confinement lasts typically 6 to 10 mu s, and is terminated by a long-wavelength, m equals 1-type motion which carries the plasma column to the wall with an effective growth rate of 0.5 to 1.0 x 10^6 s^{-1}. Photographs from a 360^0 framing camera mounted on the torus axis show this motion to consist of at least n equals 0, 1, and 2, where m and n describe motions of the form exp i(mTHETA-nz/R). A net toroidal current of 1 to 1.5 kA flowing opposite to B_0 has been measured; this current appears to be too small to account for the experimental growth rate in terms of the current-driven Kruskal–Shafranov mode. (auth)

14448 STUDY OF NEUTRON EMISSION AND TURBULENCE IN THE FOCUS EXPERIMENT WITH A TIME RESOLUTION OF THE ORDER OF A NANOSECOND. Bernard, A.; Coudeville, A.; Garconnet, J. P. (Centre d'Etudes de Limeil, Villeneuve-Saint-Georges, France). pp 83-98 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975). (In French).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

Investigations which have been in progress for several years on the Focus plasma have served to reveal new phenomena associated with the existence of microscopic instabilities. The authors present detailed results for plasma turbulence measured both from the increase in density fluctuations to a superthermal level and from the "abnormal" value of the resistance. These phenomena, which occur in the region of maximum compression, call for precise chronometry of the order of a nanosecond. Analysis of the neutron energy spectra shows that emission is always anisotropic (whatever the pressure regime chosen) and that it can be caused by the bombardment of stationary deuterons by accelerated deuterons. The authors present spectra obtained with improved resolution ($\Delta E \approx 50$ keV). Investigation of the spatial origin of the neutron emission indicates that the bulk of the neutrons are produced more than 5 cm away from the internal electrode. In this region an ionization wave created by deuterons with an energy of around 10 keV is propagated. Explosion-powered electrical generators have been developed with the aim of increasing the Focus discharge current and it has been shown that these can be used to feed the Focus plasma. From the various measurements presented it can be seen that the acceleration of particles to high energies is an indispensable mechanism in the creation of neutrons. (auth)

14449 COMPARATIVE STUDIES OF PLASMA FOCUS DEVICES. Maisonnier, Ch.; Percorella, F.; Rager, J. P.; Samuelli, M.; Strangio, C.; Messina, A. (CNEN-EURATOM, Rome). pp 99-108 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

Collimated neutron measurements on a Filippov-type experiment show that most of the neutrons are emitted near the anode in a cylinder of 3.5 cm diameter, 2 cm height, and suggest that they are of thermonuclear origin. X-ray measurements (spectrum and absolute intensity) on Filippov and Mather devices indicate the presence of intense hard X-rays coming from a zone of about 1 cm diameter on the anode, suggesting the existence of intense ($I > 10^5$ A) electron beams in the plasma. Electrical measurements on the Filippov device lead to a quantitative estimate of the energy transferred to the plasma by turbulent heating; this energy is consistent with the requirements for a thermonuclear origin of the neutrons. Energetic considerations relevant to the extrapolation of DPF devices to levels of thermonuclear interest are presented. (auth)

14450 OBSERVATION OF 10^8 GAUSS FIELDS AND PRODUCTION OF 14-MeV D–T NEUTRONS IN A DEUTERIUM PLASMA. Bostick, W. H.; Nardi, V.; Prior, W. (Stevens Inst. of Tech., Hoboken, NJ). pp 109-121 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

Two plasma focus machines (5 kJ, 0.5 MA at Stevens, 13 kJ, 0.7 MA at IEN; 3.4 cm center, 10 cm outer electrode diameter, for both machines) with D_2 gas at 8 torr produce a current sheath containing typical vortex filaments which generate their own magnetic fields along their lengths. X-ray pinhole photographs show that the plasma focus results in small apple-core-shaped x-ray sources (~0.1 mm in dia., ~0.4 mm long) which are estimated—by the intensity of the bremsstrahlung radiation—to have electron and ion densities of $10^{20} \cdot cm^{-3}$. There is evidence that these regions of concentrated plasma are the central cores of toroidal circulation patterns of magnetic field (~10^8 G), current (~4 MA), mass flow and vorticity. A typical polarization of the electric field components in microwave pulses of 1 ns duration can be related with formation and/or decay of current loops in these toroidal patterns which resemble a solenoidal threading of the vortex filaments observed in the current sheath. High-time-resolution scintillator measurements indicate that the neutron and x-ray pulses both emanate from these small concentrated regions of plasma which last (each one) about 10 ns. With only D_2 used in the filling, 14-MeV D–T neutrons as well as 2.5-MeV D–D neutrons are observed by time-of-flight. This means that in 10 ns enough tritium is being bred and confined in these plasma concentrations to give observable amounts of the D–T reaction. (auth)

Plasma Kinetics (Theoretical)

Refer also to abstract 14605.

14451 (CONF-751125-103) TRANSFORMATION OF THE SINGLE ENERGY GROUP TRANSPORT, EQUATION TO AXISYMMETRIC TOROIDAL COORDINATES. Gralnick, S. L. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). 1975. 4p. Dep. NTIS $4.00.

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The streaming term of the single energy group transport equation was derived for a general class of axisymmetric toroidal geometries using a tensor transformation formalism. The particular case of nested circular toroids treated previously by Pomraning and Stevens may be obtained by direct substitution into the equation. Other, more complicated geometries of interest to plasma physics and fusion reactor research are obtainable in the same manner. The cylindrical limit in which the azimuthal curvature is neglected may be obtained by taking the ratio of the poloidal curvature to X^1, the toroidal curvature, to zero. Similarly the planar limit results when both curvatures are small compared to the inverse of the physical dimension measured normal to the toroidal surface. (auth)

14452 (ERDA-115) SYMBOLIC COMPUTATION IN CONTROLLED THERMONUCLEAR RESEARCH. (Energy Research and Development Administration, Washington, D. C. (USA)). Mar 1974. 14p. Dep. NTIS $4.00.

The following report summarizes the panel's deliberations and makes recommendations for further ERDA activity in the area of symbolic computation. A listing is given of the types of problems which have already been solved by symbolic computation, as well as a discussion of the various software systems which have been used. A detailed discussion is given of areas of CTR research where symbolic computation is of potential usefulness. The best attempts of the panel to estimate the potential usage of symbolic computation by the CTR community are outlined. The detailed recommendations of the panel are given. (auth)

14453 (IFA-FR-133-1975) THERMAL CONDUCTIVITY OF THE THERMONUCLEAR PLASMA DOPED WITH IMPURITIES AND THERMAL PSEUDO-CONDUCTIVITY IN THE PRESENCE OF A SPACE TRANSPORT OF PARTICLES AT A CONSTANT FLUX. Cristea, G. (Institutul de Fizica Atomica, Bucharest (Romania)). 1975. 13p. Dep. NTIS (US Sales Only) $3.50.

The coefficient of the heat conductivity of a thermonuclear plasma doped with impurities is deduced with the help of a simplified physical model of the thermonuclear plasma. On the basis of the same simplified physical model, a coefficient of the heat pseudo-conductivity is deduced of the thermonuclear plasma within a spatial transport of particles exists in the form of a constant flow. (auth)

14454 (TID-26913) GENERAL PLASMA PHYSICS I, FALL SEMESTER 1973. Furth, H. P.; Rutherford, P. H. (Princeton Univ., N. J. (USA). Palmer Physical Lab.). 1973. Contract AT(11-1)-3073. 237p. Dep. NTIS $9.00.

A total of 34 lectures on various aspects of plasma physics is given. The lectures cover collisions, orbit theory, particle confinement in a torus, fluid properties of plasma, atomic processes, the Vlasov equation, transport equations, plasma diffusion, plasma waves, and Landau damping. (MOW)

14455 (TRITA-EPP-75-09) ELEMENT SEPARATION EFFECTS IN THE BOUNDARY REGION OF A PLASMA SURROUNDED BY NEUTRAL GAS. Lehnert, B. (Kungliga Tekniska Hoegskolan, Stockholm (Sweden). Institutionen foer Plasmafysik med Fusionsforskning). May 1975. 15p. Dep. NTIS (US Sales Only) $3.50.

A one-dimensional model is being considered where a fully ionized plasma is separated from a neutral gas by a homogeneous magnetic field directed along the plasma boundary. The plasma and the neutral gas consist of two different types of ions and neutral particles. In a stationary state the outflux of plasma by diffusion across the magnetic field is compensated by an influx of neutrals which are ionized in a partially ionized boundary region. (auth)

14456 (UCRL-Trans-10980) NUMERICAL MODELLING OF TWO-DIMENSIONAL LANGMUIR TURBULENCE. Polyudov, A. N.; Sagdeev, R. Z.; Sigov, Yu. S. (AN SSSR, Moscow). Nov 1975. Translation of Preprint No. 128. 44p. Dep. NTIS $4.00.

Within the framework of two-dimensional discrete modelling of plasma in x,y-geometry the evolution of a monochromatic electrostatic wave of large amplitude has been investigated. The kinetic effects associated with the self-focussing of Langmuir oscillations are considered. Expressions are obtained for the effective collision frequency, the form of the distribution function, and spectra of strong Langmuir turbulence. (auth)

14457 INITIAL VALUE PROBLEM IN RELATIVISTIC PLASMA. Godfrey, B. B.; Newberger, B. S.; Taggart, K. A. (Los Alamos Scientific Lab., NM). IEEE Trans. Plasma Sci.; PS-3: No. 4, 185-193(Dec 1975).

The Landau problem in relativistic plasma is considered in detail. It is shown how all modes in the plasma arise through proper treatment of the inverse Laplace transforms without imposition of any external conditions. A correct derivation of the asymptotic behavior of the electric field is included and estimates of the contribution of more rapidly decaying Landau modes are made analytically and are compared with numerical computations. (auth)

14458 ION ACCELERATION BY THE RELATIVISTIC TWO-STREAM INSTABILITY. Godfrey, B. B.; Thode, L. E. (Los Alamos Scientific Lab., NM). IEEE Trans. Plasma Sci.; PS-3: No. 4, 201-204(Dec 1975).

Through theoretical analysis and computer simulation, one finds that a pinched relativistic electron beam in a plasma interacts strongly with plasma ions by means of the two-stream instability. Due both to the low phase velocity of the unstable waves and to their subsequent non-linear collapse, ions are accelerated to very high energies. This process is suggested as a possible explanation for experimentally observed collective ion acceleration by electron beams. (auth)

14459 INFLUENCE OF AN ELECTROMAGNETIC WAVE OF NEAR CYCLOTRONIC FREQUENCY ON THE ELECTRONS COLLISION FREQUENCY. Gaffuri, G.; de Socio, L. (Camerino Univ., Italy). Riv. Ital. Geofis.; 23: 272-274(1974).

The energy balance is considered for the electrons in a low density plasma crossed by an electromagnetic wave, whose frequency is close to the cyclotronic frequency. Bailey's equation is solved in order to evaluate the rise-time to equilibrium of the electron collision frequency. The influence of the wave and plasma parameters on the energy rise-time is thoroughly investigated. (auth)

14460 SECULAR MODE COUPLING AND ANOMALOUS DRAG: A THEORY OF PLASMA TURBULENCE WITH APPLICATION TO THE ELECTRON BEAM–PLASMA INSTABILITY. Drake, J. F. Jr. Los Angeles; Univ. of California (1975). 296p. University Microfilms Order No. 75-17,784.

Thesis (Ph. D.).

The interaction of resonant or nearly resonant particles with waves in turbulent plasmas leads to a secular deviation of the particles from their free streaming orbits. The primary assumption in attempting to more systematically develop a theory of plasma turbulence is that the correlation time of the electric field with the charged particles is small relative to other nonlinear time scales. The final equations can be considered at two levels of accuracy. At the lowest level, mode coupling is neglected and one finds that equations describing the energy exchange between electrostatic waves and particles in a one-dimensional turbulent plasma can be obtained by simply replacing delta f(v,t)/delta v in the quasilinear equations (in both epsilon/sub k/ and delta f/delta t) by [delta f(v,t)/delta v]/sub v/. At the second level of accuracy, one finds that the turbulence breaks up the large scale coherent oscillations of particles in the plasma into spatially local oscillations, causing a broadening of the wave energy in k space. (Diss. Abstr. Int., B)

14461 INTEGRAL EQUATIONS AND DISTRIBUTION FUNCTIONS FOR HYPERDENSE PLASMAS AND A LOCAL EXCHANGE-CORRELATION APPROXIMATION FOR MANY-ELECTRON SYSTEMS. Ng, K. C. Gainesville, FL; Univ. of Florida (1974). 118p. University Microfilms Order No. 75-16,428.

Thesis (Ph. D.).

The hypernetted chain equation has been solved numerically for the classical one-component plasma up to GAMMA equals 7000. Numerical results are presented. The radial distribution functions obtained agree qualitatively with the Monte Carlo results in the fluid region, but the peak of g(r) is underestimated as much as 15 percent at GAMMA equals 160. Integral equations are investigated for the purpose of finding the one most suitable for a dense system of nuclei and electrons. A local exchange-correlation approximation for calculating the ground-state wavefunction and energy for a finite system of electrons is introduced. The new scheme differs from the well-known Kohn–Sham scheme in two aspects: (i) the local approximation is made to the correlation function rho_2 (1,2)-rho(1)rho(2) instead of the functional E_{XC}[rho] and (ii) the one-electron equation is derived with the usual Rayleigh-Ritz variational principle instead of the variational principle of Hohenberg and Kohn. (Diss. Abstr. Int., B)

14462 THEORY AND EXPERIMENTS IN THE SIMULATION OF COLLISIONLESS PLASMAS. Drobot, A. T. Austin, TX; Univ. of Texas (1975). 198p. University Microfilms Order No. 75-16,665.

Thesis (Ph. D.).

A numerical simulation code to follow the evolution of collisionless plasma interactions was formulated from a one-dimensional (1-D) plasma model. The motion of plasma particles was treated in both the Newtonian and relativistic limits while the self-consistent electric field was assumed to be electrostatic. A linear analysis of the code revealed the similarity of the resulting dispersion relation to that of the collisionless Vlasov equation for wavelengths characterized by k less than [1/DELTA x, 1/lambda D/], where DELTA x is a cell width introduced by the numerical algorithm and lambda/sub D/ is the Debye length. For shorter wavelengths the code produced unphysical results and techniques were developed to suppress behavior stemming from the use of finite cell width, finite timestep, and the small number of macroparticles used to represent the plasma. Kinetic theory formulated to include discreteness effects further revealed the requirements on simulation parameters to maintain a collision frequency smaller than time scales of interest. (Diss. Abstr. Int., B)

14463 ANALYSIS OF THE RELAXATION OF WALL ELECTRONS IN A PLASMA. Ecker, G.; Riemann, K. U.; Scholz, A. (Bochum Univ. (F. R. Germany). Inst. fuer Theoretische Physik). Z. Naturforsch., A; 30: No. 8, 937-946(Aug 1975).

4 figs.; 6 refs.

A procedure is developed which renders the simultaneous description of angular and energy relaxation of wall electrons in a plasma possible. The plasma is assumed to be field free, allowance is made for elastic and inelastic collisions with neutrals, as well as for electron-electron encounters. The procedure is based on an expansion in terms of the eigenfunctions of a suitable part of the kinetic equation. In the zeroth order, the problem is reduced to a boundary value problem of the Sturm type, and subsequent solution of a singular integral equation by standard technique. To account for the rest of the kinetic equation, we construct a Green's function which forms the basis for an iteration process. The application of the procedure is illustrated with an example. (GE)

14464 STIMULATED THERMAL SCATTERING OF ELECTROMAGNETIC WAVES IN PLASMA. Litvak, A. G.; Mironov, V. A. (Scientific-Research Radiophysics Inst., Gorky, USSR). Izv. Vyssh. Uchebn. Zaved., Radiofiz.; 18: No. 6, 828-832(1975). (In Russian).

A linear stage of thermal scattering of an electromagnetic wave in the isotropic plasma with weak absorption is considered. The increments of instabilities are calculated and threshold fields are defined. The conditions when the considered effects are stronger than the similar collisionless effects are clarified. (auth)

14465 PLASMA PERTURBATION BY STRONG ELECTROMAGNETIC WAVES. Chernogor, L. F. (Kharkov State Univ.). Izv. Vyssh. Uchebn. Zaved., Radiofiz.; 18: No. 6, 847-857(1975). (In Russian).

The problem of perturbation of a weakly inhomogeneous plasma by a strong electromagnetic wave is considered. Formulas are obtained which describe small changes in density and temperature of electrons when the field is switched on and off in one- and three-dimensional cases. The plasma perturbation by a traveling pulse is also considered. The possibility of using the given relations in the investigation of microprocesses in plasma is discussed. (auth)

14466 KINETIC THEORY OF REFLECTION OF AN ELECTROMAGNETIC WAVE FROM A MOVING MAGNETOACTIVE PLASMA. Bogomolov, Yu. V. Izv. Vyssh. Uchebn. Zaved., Radiofiz.; 18: No. 6, 840-846(1975). (In Russian).

The problem of reflection of a plane electromagnetic wave from a moving plasma semi-space is considered. It is assumed that the wave slowed-down by a dielectric is obliquely incident on the plasma boundary, the constant magnetic field is parallel to the boundary and the electric wave field is parallel to the constant magnetic field. The full surface impedance is calculated for different boundary models (mirror, diffusive) in the weak spatial dispersion approximation.

14467 THEORETICAL STUDY OF THE INFLUENCE OF AMBIPOLAR DIFFUSION ON THE POPULATION DISTRIBUTION OF EXCITED STATES IN A PLASMA. Numano, M.; Cussenot, J. R.; Fabry, M.; Felden, M. (Univ., Nancy). J. Quant. Spectrosc. Radiat. Transfer; 15: No. 11, 1007-1016(Nov 1975).

The effect of charged particle diffusion on excitation temperature was investigated theoretically, assuming that the diffusion processes are ambipolar and that the charged particles return to the plasma in the form of ground state atoms, after recombination at the plasma boundary. An approximate expression was obtained by solving a set of balance equations for the excited state atom densities. It shows that, with increase of the plasma pressure, the excitation temperature rises and approaches the electron temperature. It was found also that, as the electron density increases, the diffusion effect on the excitation temperature diminishes. A criterion was obtained which should be satisfied so that the excitation temperature may be in agreement with the electron temperature. The theoretical results of this paper are in good agreement with experimental results. (auth)

14468 MODELS FOR QUASI-LINEAR EQUATIONS. Abraham-Shrauner, B. (Department of Electrical Engineering, Washington University, St. Louis, Missouri 63130). Phys. Fluids 18: No. 12, 1748-1755 (Dec 1975).

The quasi-linear equation for a weakly turbulent plasma is treated by specifying the time dependence of the imaginary part of the frequency of a mode $\gamma_k(t)$ for several models. For unstable plasmas an oscillatory diffusion coefficient, D, is found and several methods are discussed for insuring that D is positive. For wave modes that stabilize at high electric field fluctuation levels, it is found that the one-particle distribution function must be treated as an operator if the diffusion time is equal to or greater than growth time. Our results confirm the picture given by Burns and Knorr within the limits of our models. (auth)

14469 COLLISIONS IN MULTI-DIMENSIONAL PLASMA SIMULATIONS. Matsuda, Y.; Okuda, H. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08540). Phys. Fluids 18: No. 12, 1740-1747 (Dec 1975).

Collisions in multi-dimensional plasma simulation models using finite-size particles are studied numerically and analytically. Drag and diffusion of particles in velocity space are measured and are compared with the theoretical predictions for two-, two-and-a-half-, and three-dimensional models. For two- and three-dimensional models, the measurement agrees reasonably well with the Balescu–Lenard theory. For the two-and-a-half-dimensional model, it is shown that the collisions strongly depend on the choice of the angle between magnetic field and wave vector due to the limited phase space available in the model. For a strongly magnetized plasma with $\Omega_e > \omega_{pe}$, the effective collisions are significantly reduced for a simulation plasma when $a \gtrsim \rho_e$ (where a is particle size, and ρ_e is the gyroradius) in contrast to a real plasma where the effective collisions depend weakly on the magnetic field. (auth)

14470 THREE-DIMENSIONAL GUIDING-CENTER PLASMAS. Knorr, G. (Department of Physics and Astronomy, The University of Iowa, Iowa City, Iowa 52242). Phys. Fluids 18: No. 11, 1546-1551 (Nov 1975).

A three-dimensional guiding-center plasma model is derived from the Vlasov equation using a method by Frieman, Davidson, and Langdon. In two dimensions the reduction of the description to configuration space occurs only for homogeneous magnetic fields. Macroscopic equations are derived for a homogeneous magnetic field and the stability of nonneutral plasmas is investigated. Sheets consisting of magnetic field lines and charged positively show unstable behavior if $k_\parallel/k_\perp < a/c_s$, where a is the E×B drift and c_s is the ion sound velocity. $k_\parallel$ and $k_\perp$ are the wavenumbers parallel and perpendicular to the magnetic field. Sheets with electron charges are stable if the phase velocity of the disturbance along B is smaller than the electron thermal velocity. (auth)

14471 IMPROVED VARIATIONAL METHOD FOR AXISYMMETRIC PLASMAS. Shumaker, D.E. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550); Bernstein, I.B. Phys. Fluids 18: No. 11, 1487-1488 (Nov 1975).

An improved variational method for determining transport coefficients in axisymmetric plasmas is given. The advantage of the method is that the induction electric field is determined as an independent unknown and can be approximated by means of trial functions. (auth)

14472 RELAXATION OF AN ISOTROPIC PLASMA WITH TWO DIFFERENT ENERGY POPULATIONS. Peyraud, N. (Laboratoire de Physique de la Matière Condensée, 06100 - Nice, France). Phys. Fluids 18: No. 11, 1477-1486 (Nov 1975).

The relaxation of isotropic plasma toward thermodynamic equilibrium is studied. Such plasmas are linearly stable and the relaxation is mainly governed by electron-electron interactions. It is shown that if there is a bump-on-tail of the distribution function, due, for example, to efficient superelastic collisions in a plasma with metastable atoms, the relaxation frequency becomes larger than the classical electron-electron relaxation frequency. (auth)

14473 ELECTRON-STREAM—SOLID INTERACTION. McCorkle, R.A. (IBM Thomas J. Watson Research Center, Yorktown Heights, New York 10598). Phys. Rev. Lett. 35: No. 20, 1344-1346 (17 Nov 1975).

High-current, relativistic, electron streams with low energy of transverse motion undergo very tight pinching in high-density matter. Power flux densities of 10^{16} W/cm^2 are realizable from modest electron streams, 50–100 kA at several MV, interacting with solids. Both cylindrical and spherical self-generated interaction geometries obtain from conditions realizable by use of dielectric-rod cathodes. (auth)

14474 A HYBRID-KINETIC MODEL FOR HIGH-β PLASMAS. D'Ippolito, D.A. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742); Davidson, R.C. Phys. Fluids 18: No. 11, 1507-1523 (Nov 1975).

A hybrid-kinetic model (Vlasov ions and drift-kinetic electrons) is developed to describe the equilibrium and stability properties of collisionless high-beta plasmas in arbitrary magnetic field configurations. No ordering of ion properties (such as ω/Ω_i and r_{Li}/L_i) is assumed, so the ions are described by the exact (unexpanded) Vlasov equation. The electrons are assumed to be strongly magnetized with $\omega/\Omega_e \sim r_{Le}/L_\perp = \epsilon \ll 1$, and the electron Vlasov equation is expanded in ϵ to give a drift-kinetic equation for f_e. Examples of linear screw-pinch equilibria are constructed to demonstrate the ease with which equilibrium solutions are found within this formalism. Also, it is shown that the hybrid-kinetic model correct to $O(\epsilon)$ includes physical effects which are important during the implosion and immediate post-implosion phases of high-density pinch experiments, where stability behavior is characterized by the fast time scale $\omega^{-1} \sim_{LH} = (\Omega_e\Omega_i)^{-1/2}$. In particular, a local dispersion relation is derived for the modified-two-stream and lower-hybrid-drift instabilities, which have characteristic growth rates of order $(\Omega_e\Omega_i)^{1/2}$ when $\omega^2_{pe}/\Omega^2_e \gg 1$. (auth)

14475 THEORETICAL AND NUMERICAL STUDIES OF HIGH-beta PLASMAS. Krall, N. A. (Lab for Applied Plasma Studies, La Jolla, CA); Hamasaki, S.; Davidson, R. C. pp 373-380 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381-(Vol.3); CONF-741105-P3.

A fluid-numerical model which has been successful in predicting and explaining theta-pinch behavior is further applied and extended. One application is to the study of the structure of equilibrium sheaths in finite-beta plasmas; in addition, the code is extended to include effects found in higher-density partially ionized experiments and applied to calculation of the behavior of the Scylla 1-B experiment. A major extension of the technique is to combine the fluid electron code with a particle simulation code to include the effect of reflected ions; this code is applied to a study of implosion heating of the LASL toroidal screw pinch ZT-1. A numerical technique is devised for initializing two-dimensional particle-in-cell simulation of pinch sheath evolution, and examples of equilibrium are presented. (auth)

14476 COMPUTER SIMULATION OF A TOROIDAL PINCH. Ashida, H. (Electrotechnical Lab., Tokyo). pp 471-481 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

Equilibrium and stability of a toroidal pinch are discussed by a numerical simulation in two dimensions. In the screw-pinch case, the toroidal displacement is in good agreement with Shafranov's theory rather than with the constant-pitch-model theory. Joule heating of a tenuous plasma is more effective in the inner region than in the outer region of the toroidal plasma. The toroidal displacement, therefore, does not decrease owing to the current flowing in the tenuous plasma. In the positive-bias case, a safety factor of $q > 1$ is easy to achieve, but q shows a minimum. If the axial current starts immediately before the toroidal-compression field, the minimum becomes smaller and disappears because of diffusion of the poloidal magnetic field toward the magnetic axis as long as the aspect ratio is large. In the stabilized-pinch case, the minimum of q also disappears if the plasma pinch is weak. It is, however, difficult to achieve equilibrium because of the large value of β_θ. In the case of a pinch with an elliptic cross-section, the q-configuration is improved as far as stability is concerned. (auth)

14477 COMPUTATIONAL STUDIES OF TWO-COMPONENT MIRROR REACTORS. Byers, J. A.; Freis, R. P.; Killeen, J.; Lee, E. P.; McNamara, B.; Mirin, A. A.; Rensink, M. E. (Univ. of California, Livermore). pp 551-556 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381(Vol. 3); CONF-741105-P3.

An extensive study was made of the energetics, equilibrium, and stability of two-component mirror systems. Collisional target plasmas are described by equilibrium fluid flow equations in the Marteni computer code. The Marteni code is coupled to a particle simulation code for application to an arc target plasma. The particle code determines the net transfer of directed beam energy to the plasma (typically 10 to 15 percent maximum) and this produces input for the power balance of the Marteni code that determines T/sub e/. For two-component systems supported by neutral injection, we couple the Marteni code to Fokker-Planck (MFP) codes that describe the collisional decay of the injected species. A radial transport code that gives information on the trapping fraction of the neutral beam and on volume erosion of the target plasma is included. In the simplest cases, the codes produce predictions of T/sub e/ that are a factor of 2 to 3 lower than previous estimates. Self-consistent magnetic field effects are calculated with a particle simulation code that shows long-lived reversed-field configurations are possible. The MFP codes predict that velocity space instabilities are definitely present during the build-up phase, will occur even in the steady state for low mirror ratios, R approximately 2, and can possibly be stabilized by high mirror ratios R greater than or equal to 10. Particle simulation codes predict a spreading of the hot-ion energy spectrum. (auth)

Plasma Production

14478 (INIS-mf-1855, pp 55-70) PRODUCTION OF AN EXTREMELY QUIESCENT PLASMA. 16 Apr 1975.

This is modified version of an article by A. Goede, G. J. Brakenhoff, H. J. Hopman and P. Massmann, Phys. Rev. Lett., v. 27 (1971) p. 1044; 14 refs., 6 figs.

In ion beam plasma interaction. The production of a quiescent plasma.

An extremely quiescent magnetized plasma, with a noise level of $< \delta n/n \geq 2 \times 10^{-3}$, has been produced with the application of small permanent magnets. The magnets are arranged around the plasma column in a multipole configuration. Together with an axial magnetic field they create an average minimum-B field. The steady-state plasma column produced in this field by an ECR discharge, not only proves to be extremely quiescent, but also has a nearly uniform density distribution along the axis; $\Delta n/n\ \Delta z = 2 \times 10^{-3}\ cm^{-1}$. Densities up to $10^{11}\ cm^{-3}$ are produced in Helium at 3.5×10^{-3} Torr. The electron temperature is about 10 eV. Detailed measurements are presented on the spatial distribution of this unique magnetic field configuration. (auth)

14479 NUMERICAL AND EXPERIMENTAL RESULTS ON THE PRODUCTION OF WEAKLY COMPRESSED THERMONUCLEAR PLASMAS IN THE GARCHING HIGH-VOLTAGE THETA AND BELT PINCH. Chodura, R.; Dum, C. T.; Keilhacker, M.; Kornherr, M.; Neidermeyer, H.; Protz, R.; Soeldner, F.; Steuer, K. H. (Max-Planck-Institut fuer Plasmaphysik, Garching, Ger.). pp 397-405 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

The production of high-temperature weakly compressed plasmas by high-β shocks is investigated in a high-voltage theta and belt pinch. Density, electron and ion temperatures and magnetic field profiles are measured by laser-light scattering, neutron yield and probes. Shock dynamics is simulated with a 1-d hybrid fluid-particle code; turbulent transport coefficients used in this code are derived from investigations of the ion-acoustic instability in a separate 2-d particle code. Magnetic field profiles and electron temperature in the shock (T_e = 2 keV) are consistent with transport coefficients for ion-acoustic turbulence. Enhanced resistivity and reduced axial heat conduction can be explained by the same turbulent "collision frequency" $\nu_{eff} \approx 5 \times 10^{-3}\ \omega_{pe}$. Experiment and simulation show that the neutron yield is due to counterstreaming beams of ions reflected at the potential jump in the piston. After shock compression a dense ($4 \times 10^{14}\ cm^{-3}$) $\beta = 1$ plasma core consisting of hot ions (E_i = 1.5 keV) and cold electrons is observed. A compression ratio $R_c/r_{pl} \approx 1.8$ is reached. The observed plasma halo surrounding the main plasma column is due to MHD-instabilities with high m-number. The wavelength of these modes is found experimentally to be $\lambda \propto n_0^{-\frac{1}{2}}$. First results in the belt-pinch geometry show that weakly compressed high-temperature plasmas can also be produced in toroidal systems. (auth)

14480 MODEL FOR CONVERSION OF INTENSE-ELECTRON-BEAM ENERGY INTO RADIALLY CONVERGING ION FLUXES. Goldstein, S.A.; Guillory, J. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). Phys. Rev. Lett. 35: No. 17, 1160-1163 (27 Oct 1975).

The pinch phenomenon in relativistic diodes is used with proper design of the anode surface to construct a theoretical scheme for ion acceleration. We analyze the early-time formation of the ion source, and give the approximate solutions for the steady state of ion and electron flow. Efficient conversion (>50%) of electron current into ion current is predicted. The energetic ions are accelerated radially inwards in spherical geometry. Application to the generation of intense neutron pulses and pellet compression is discussed. (auth)

14481 OPTIMAL FOCUSING OF LASER RADIATION ON THE SURFACE OF A SOLID TARGET. Koshelev, K.N.; Chekalin, S.V.; Churilov, S.S. (Institute of Spectroscopy, Academy of Sciences of the USSR, Akademgorodok, Moscow Province). Sov. J. Quantum Electron. 5: No. 7, 871-872 (July 1975).

An investigation was made of the dependence of the electron temperature of a plasma, generated by heating a solid target with focused laser radiation, on the position of the focusing objective relative to the target surface. It was found experimentally that the position corresponding to the maximum electron temperature of the plasma did not represent exact focusing of the laser radiation on the target surface. The plasma heating process was most efficient when the focus of the objective was located ~100 μ above the target surface. A possible explanation of this result was considered. (auth)

14482 EXPERIMENTAL INVESTIGATION OF THE ONSET OF EVAPORATION AND FORMATION OF A PLASMA LAYER DUE TO INTERACTION BETWEEN LASER RADIATION AND METALS IN DIFFERENT GASES. Kozlova, N.N.; Petrukhin, A.I.; Sulyaev, V.A. (O. Yu. Shmidt Institute of Physics of the Earth, Academy of Sciences of the USSR). Sov. J. Quantum Electron. 5: No. 7, 747-749 (July 1975).

The results are given of an experimental investigation of the onset of evaporation and of the appearance of a plasma layer above a target irradiated with neodymium laser pulses of about 1 μsec duration. The targets were aluminum and bismuth in air, argon, and helium. The critical density of the radiation flux, below which no "flash" was observed for pulses of this duration, was determined for near-planar motion. The results obtained were compared with theoretical ideas and the results of other experiments. (auth)

14483 SEEDED MEGAGAUSS TURBULENCE IN DENSE FUSION-TARGET PLASMAS. Tidman, D.A. (Institute for Fluid Dynamics and Applied Mathematics, University of Maryland, College Park, Maryland 20742). Phys. Rev. Lett. 35: No. 18, 1228-1231 (3 Nov 1975).

A collision-dominated inhomogeneous plasma seeded with a distribution of impurity grains is calculated to fill out rapidly with random megagauss fields for temperatures of about a kilovolt. Possible applications of this phenomenon (i) to enhance relativistic-electron-beam coupling to low-Z target plasmas, (ii) to influence transport coefficients, or (iii) to localize α-particle deposition in a reacting DT plasma are discussed. (auth)

14484 NEGATIVE ION PLASMAS. Wong, A.Y.; Mamas, D.L.; Arnush, D. (TRW Systems, Redondo Beach, California 90278). Phys. Fluids 18: No. 11, 1489-1493 (Nov 1975).

In a plasma composed of negative (SF^-_6) ions, positive (Ar^+) ions, and electrons (with n_-/n_+ reducible to less than 10^{-3}) a fast ion mode ($\nu_{ph} \simeq 9C_s$), due to the out-of-phase motion between positive and negative ions, is observed with reduced spatial attenuation. This fast ion mode exhibits spatial growth in the presence of a fast ion beam. Diffusion properties of the negative ion plasma are also presented. (auth)

Plasma Stability

Refer also to abstracts 14403, 14407, 14458, and 14587.

14485 (CONF-750356, B1-B14) SOME NEW DEVELOPMENTS IN THE PHYSICS OF BEAM–PLASMA INTERACTIONS. Bakai, A. S.; Krivulya, S. S.; Mazalov, Yu. P.; Rutkevich, B. N.; Fedorchenko, V. D. (Physical Technical Inst., Kharkov). 1975.

From 2nd international congress on waves and instabilities in plasmas (SICWIP); Innsbruck, Austria (17 Mar 1975).

In second international congress on waves and instabilites in plasmas. Survey lectures.

Beam–plasma instabilities are studied both in theoretical and experimental aspects. Nevertheless, there have been discovered some phenomena presenting new possibilities in controlling the development of beam–plasma instabilities in using beam–plasma systems as oscillation amplifiers and generators. This report presents a short survey of the new phenomena observed by the authors when investigating the dynamics of instability development in bounded beam–plasma systems. (auth)

14486 (CONF-750356, pp Bi1-Bi31) THEORY OF ANOMALOUS LASER–PLASMA INTERACTION. Biskamp, D. (Max-Planck-Institut fuer Plasmaphysik, Garching, Ger.). 1975.

From 2nd international congress on waves and instabilities in plasmas (SICWIP); Innsbruck, Austria (17 Mar 1975).

In second international congress on waves and instabilities in plasmas. Survey lectures.

The interaction of plasmas with intense laser light has become a field of active theoretical and experimental research since the sharp rise of interest in the laser fusion concept a few years ago. In this concept a pellet of fusionable material will be highly compressed and heated to thermonuclear ignition by an appropriate laser pulse. Since a light wave of frequency ω_0 can propagate in a plasma only for subcritical densities $n < n_c$, where n_c is defined by $\omega_{pe} = \omega_0$, and high-power laser systems for practical use are restricted to wavelengths $\lambda \geq 1\ \mu$, the laser-plasma interaction, particularly light absorption, takes place in a thin plasma corona surrounding the pellet, from where the energy absorbed is transported into the interior mainly by electron thermal conduction. Since laser intensities $P > 10^{16} W/cm^2$ are required for fusion conditions, laser-plasma interaction can take place only through collective effects, thus leading to anomalously enhanced light absorption and scattering as well as reduced heat conduction. In this review lecture a brief survey of the basic properties of the various collective processes is given, and recent results on parametric processes are discussed in greater detail and compared with observations in laser-target experiments. (WHK)

14487 (CONF-750356, pp H1-H42) ELECTROTHERMAL WAVES AND INSTABILITIES IN PARTIALLY AND FULLY IONIZED PLASMAS. Haines, M. G. (Imperial Coll., London). 1975.

From 2nd international congress on waves and instabilities in plasmas (SICWIP); Innsbruck, Austria (17 Mar 1975).

In second international congress on waves and instabilities in plasmas. Survey lectures.

Under the effect of Ohmic heating the temperature of the electrons can be elevated above that of the ions or neutral atoms because of the finite electron-heavy-particle energy exchange time. The resulting non-equilibrium state can cause an instability. In the case of a weakly ionized gas perturbations of electron temperature lead to large changes in electron density on a time scale dictated either by the approach to a Saha equilibrium or by the supply of energy for ionization. The increased ionization increases the energy loss in the equipartition term by an amount greater than can be supplied by the perturbed J.E. in absence of a magnetic field. However, in the presence of a transverse magnetic field Hall currents also flow and it is possible for the Ohmic dissipation to exceed the equipartition term and cause an instability. The critical Hall parameter is about 1 to 2. Furthermore the convective term and the compressional term in the electron energy equation modify the instability and cause an overstable wave. The theoretical models generally neglect the ion and neutral atom perturbations. This is valid when the electron number density is much less than the total heavy particle number density. Good agreement is found between experiment and theory, and in both cases (the latter employing computational techniques) the non-linear growth leads to the formation of streamers or current filaments. For a fully ionized gas the energy sink for the electron gas is purely through temperature equilibriation to the ions. No magnetic field is required to provide the onset of the instability which is now determined primarily by the equilibrium temperature ratio or Ohmic dissipation. However with equal electron and ion number densities, the ion motion cannot now be neglected, and this can also lead to an overstable wave in addition to a stationary unstable mode. The critical temperature ratio T_e/T_i for the instability is 1.3187 in the limit of large density and low temperature. Thermal conduction and Faraday 's law lead to an optimum wavelength for growth. (auth)

14488 (CONF-750356, pp K1-K46) INSTABILITIES IN THE PLASMA FOCUS. Kaeppeler, H. J. (Univ., Stuttgart). 1975.

From 2nd international congress on waves and instabilities in plasmas (SICWIP); Innsbruck, Austria (17 Mar 1975).

In second international congress on waves and instabilities in plasmas. Survey lectures.

The plasma focus was studied by many research teams in view of a possible approach to controlled thermonuclear fusion. Though it is questionable whether the plasma focus will ever lead to a fusion reactor, it nevertheless constitutes a strong source of neutron, x- and gamma radiation for simulating fusion reactor conditions. Furthermore, the plasma focus yields very high temperatures (10^7 °K) and densities ($> 10^{19}$ cm^{-3}) and thus provides interesting conditions for the study of high density plasmas. This review paper starts with a description of the compression stage of the focussing plasma, using a snow-plough model. It is shown that sophisticated MHD calculations substantiate the snow-plough theory; however they are not suited to describe the phenomena in the final compressed stage. For this purpose, a particle-in-cell calculation is employed, yielding a beam-beam collision model for the neutron production. Experimental evidence indicates that neutron production is associated with the appearance of $m = 0$ instabilities and is the direct result of collisions between anomalously accelerated ions. One of the mechanisms of ion acceleration is strong local electric fields. Another possible mechanism can be seen in beam-plasma instabilities caused by runaway electrons. The analytical derivation of the dispersion relation for plasma focus conditions including runaway effect is discussed. (auth)

14489 (CONF-750356, pp L1-L9) THERMONUCLEAR INSTABILITIES IN A TOKAMAK. Kaladze, T. D. (Tbilisi State Univ., USSR); Lominadze, J. G.; Mikhailovskii, A. B. 1975.

From 2nd international congress on waves and instabilities in plasmas (SICWIP); Innsbruck, Austria (17 Mar 1975).

In second international congress on waves and instabilities in plasmas. Survey lectures.

In the connection with construction of large thermonuclear devices of tokamak type, studies of the effects caused by α-particles, formed in the fusion reaction, become more and more actual. Often while calculating the energy balance only transport coefficients, caused by Coulomb collisions, are taken into account. However, it is known that produced α-particles initially have a non monotonous distribution over energies and hence, can lead to instabilities and relate to them anomalous (no Coulomb) transport coefficients. The development of experimental studies of the tokamak problem required elucidation of the problem to what extent the theory of instabilities of α-particles, developed in the approximation of the uniform magnetic field, can be used under the condition of the curved magnetic field of a tokamak and studies of those types of instabilities of α-particles for which the geometry of the magnetic field is important. The main results of the linear theory of instabilities of α-particles, developed taking account for the tokamak geometry and the quasilinear theory of relaxation of α-particles, are reviewed. (WHK)

14490 (CONF-750356, M1-M17) THEORY OF BIFURCATED PLASMA EQUILIBRIA AND ITS RELATION TO THE THERMODYNAMIC STABILITY AND THE DISRUPTIVE INSTABILITY. Minardi, E. (Culham Lab., Abingdon, Eng.). 1975.

From 2nd international congress on waves and instabilities in plasmas (SICWIP); Innsbruck, Austria (17 Mar 1975).

In second international congress on waves and instabilities in plasmas. Survey lectures.

The bifurcation theory is the part of the nonlinear analysis which considers the changes in the number of solutions of a system of equations depending continuously on a parameter, as the parameter varies. His interest in physics lies on the fact, first shown by Poincaré, that the existence of a bifurcation is connected with the stability properties of a dynamical system. The present lecture is dedicated to the illustration of the relations between the bifurcation theory and the stability properties of a plasma equilibrium, both from the point of view of the dynamics or of the thermodynamics of the collisionless plasma equilibria. In fact the existence of a bifurcation depends on very general mathematical properties of the involved operators which in turn reflect basic physical properties of the system. One should distinguish between the existence of a bifuraction in a problem of static plasma equilibrium or in the problem of the dynamical behavior of the perturbed equilibrium. The two cases coincide for "adiabatic" perturbations, namely such that the functional form of the distribution function is unchanged. In this case the system is unstable both from the point of view of the dynamical or of the thermodynamical description. However, situations occur in which a bifurcation exists in the equilibrium problem while the system is dynamically stable. In this case the equilibrium is still thermodynamically unstable with respect to nondynamical perturbations, namely such that the system is describing a succession of equilibria, as a consequence of an external slow time dependence of the parameters, resulting from a small amount of dissipation. The existence of the bifurcation then implies a disruption of the old equilibrium and the realization of a new thermodynamically more favored equilibrium. The disruption observed in Tokamaks is quite likely related to a process of this kind. (auth)

14491 (ERDA-tr-106) SEVERAL PROBLEMS IN THE THEORY OF TOKAMAK MICROINSTABILITIES. Lominadze, D. G.; Mikhailovskii, A. B.; Tang, W. M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1975. Translation of IAE-2584. 11p. Dep. NTIS $3.50.

Results of recent work on the theory of Tokamak microinstabilities are analyzed. Considerations are expressed as to which of the yet-unsolved problems of this theory are of interest as objects of research for the near future. (auth)

14492 (MATT-1199) MHD EQUILIBRIUM PROPERTIES OF TOKAMAK FUSION REACTOR DESIGNS. Todd, A. M. M.; Grainick, S. L.; Dalhed, H. E. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). Jan 1976. Contract E(11-1)-3073. 25p. (CONF-751125-119). Dep. NTIS $3.50.

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The equilibrium properties of several Tokamak Reactor Designs are analyzed and compared for varying pressure and current profiles using the Princeton Equilibrium Code. It is found that the UWMAK configuration has a broader range of equilibria than the Princeton Reference Design configuration, but that the safety factor on axis is less than unity for peaked current distributions. The Argonne Experimental Power Reactor has a satisfactory range of equilibria, but a means of limiting or diverting the plasma has not yet been proposed, and this may substantially change the results obtained. (auth)

14493 (MATT-1200) SOME EFFECTS OF PARALLEL ENERGY PROPAGATION ON THE STRUCTURE OF DISSIPATIVE TRAPPED ELECTRON MODES. Sauthoff, N. R. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). Jan 1976. Contract E(11-1)-3073. 10p. Dep. NTIS $3.50.

The limitation of ballooning by parallel energy propagation is investigated for the dissipative trapped electron mode, wherein the local energy influx is proportional to the poloidally dependent trapped particle fraction. For small energetic asymmetries [mg less than 2.5 (OMEGA/sub 1/a/c/sub s/) (a/R/sup $^3/_4$/] the structure along the field line is predominantly a phase shift, dictated by the condition that the asymmetric energy input be compensated by parallel energy flow. For large asymmetry, mode number, and parallel arc length, the phase and amplitude variations necessitate an integral equation treatment. (auth)

14494 (TRITA-EPP-75-01) STABILIZATION OF KINK DISTURBANCES BY INHOMOGENEOUS MAGNETIC FIELDS. Hellsten, T. (Kungliga Tekniska Hoegskolan, Stockholm (Sweden). Institutionen foer Plasmafysik med Fusionsforskning). Jan 1975. 27p. Dep. NTIS (US Sales Only) $4.00.

Kink disturbances are investigated for a perfectly conducting cylinder with circular and rigid cross section, being placed in the octupole field generated by four external parallel current-carrying straight conductors. The inhomogeneous magnetic vacuum field stabilizes the disturbances, on account of the inductive field changes. This stabilizing effect increases rapidly as the conductor positions are made to approach the cylinder. The analysis is performed both in absence and in presence of an axial magnetic field. (auth)

14495 (UCRL-51800) KINK INSTABILITIES AND THE GAS-EMBEDDED Z-PINCH. Hartman, C. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 30 Apr 1975. Contract W-7405-Eng-48. 11p. Dep. NTIS $3.50.

A comparison of a previous gas-embedded Z-pinch experiment (by E. Smars) is made using a nonlinear theory of kink instability (by W. Manheimer, et al.). Good agreement is found for some experimental cases while for others the theory predicts too fast a growth of the kink. To account for this discrepancy the evolution of topologically different secondary currents is postulated. (auth)

14496 LINEAR THEORY OF THE E × B INSTABILITY. Weng, C. I.; Ma, C. S. (National Cheng Kung Univ., Tainan, Taiwan). Chin. J. Phys. (Taiwan); 13: No. 1, 44-54(Apr 1975).

A linear analysis of the E × B instability in cylindrical coordinates in a weakly ionized plasma is studied. It is shown that the qualitative feature of instability is in agreement with Simon's result of slab model. The system is unstable when the sign of the product of the electric field and the density gradient is positive and the applied potential is large enough. It is also shown that the oscillation frequencies of the excited modes fit Saito's experimental results very well in the quantitative feature. (auth)

14497 EFFECTS OF FLUID INSTABILITIES ON LASER FUSION PELLETS. Mead, W. C.; Lindl, J. D. (Lawrence Livermore Lab., CA). pp 27-52 of Progress in Lasers and Laser Fusion. Perlmutter, A. (ed.). New York; Plenum Press (1975).

From Orbis scientist meeting; Coral Gables, Florida, USA (21 Jan 1975). See CONF-750110-P2.

The discussions cover the following areas, code tests and anomalies, comparison with previous work, current understanding of fluid instability in the presence of ablation, and the implications of these results for laser fusion target design. (MOW)

14498 BEAM–PLASMA INTERACTIONS IN A COLLISIONAL PLASMA SYSTEM. Sata, M.; Heider, J. (Univ., Munich). J. Phys., D (London); 8: No. 14, 1632-1639(1 Oct 1975).

The interaction of an electron beam with a collisional plasma is studied experimentally. The property of a beam-generated plasma, the energy spectrum of electrons and the spatial growth of the instability are examined by changing the pressure (1 to 70 mTorr), beam voltage (300 to 1000 V) and current (1 to 10 mA) in hydrogen or helium gas. The results are compared with existing theories which take into account collisional effects. The calculation and measurement show that the half-width of the wave signal in the linear region is proportional to the collision frequency of the plasma electrons, independent of other system parameters. (auth)

14499 EXCITATION AND LINEAR MODE CONVERSION OF LOW HYBRID RESONANCE CONES IN AN INHOMOGENEOUS

PLASMA. Kuehl, H.H.; Ko, K.K. (University of Southern California, Los Angeles, California 90007). Phys. Fluids 18: No. 12, 1816-1818 (Dec 1975).

The field near the resonance cone for frequencies near the lower hybrid frequency is considered. By including higher-order thermal terms, the proper nonsingular fields near the resonance cones due to a localized rf source at the plasma boundary are derived. (auth)

14500 SATURATION SPECTRUM OF THE PARAMETRIC DECAY INSTABILITY IN THE PRESENCE OF AN EXTERNAL MAGNETIC FIELD. Chen, H.C.; Fejer, J.A. (Department of Applied Physics and Information Science, University of California, San Diego, La Jolla, California 92037). Phys. Fluids 18: No. 12, 1809-1812 (Dec

The effects of an external magnetic field on the saturation spectrum of parametric instabilities are calculated and are discussed in the context of ionospheric heating experiments. (auth)

14501 ONSET, GROWTH, AND SATURATION OF THE CURRENT-DRIVEN ION CYCLOTRON INSTABILITY. Correll, D.L.; Rynn, N.; Böhmer, H. (Physics Department, University of California, Irvine, California 92664). Phys. Fluids 18: No. 12, 1800-1808 (Dec 1975).

The temporal evolution of the current-driven electrostatic ion cyclotron instability was investigated experimentally. The critical destabilizing electron drift velocity for different values of mode phase velocity was measured. The phase velocity was changed by varying the effective plasma column length and hence the parallel wavelength. Ion cyclotron damping was observed to dominate over electron Landau damping at low phase velocities. The temporal growth rate was experimentally determined for several values of electron drift and found to agree very well with linear theory. The observed saturated mode amplitudes compare favorably with the saturation levels predicted by a theory of nonlinear stabilization due to wave induced collisions. (auth)

14502 KINETIC THEORY OF TEARING INSTABILITY. Hazeltine, R.D.; Dobrott, D.; Wang, T.S. (General Atomic Company, San Diego, California 92138). Phys. Fluids 18: No. 12, 1778-1786 (Dec 1975).

The guiding-center kinetic equation with Fokker-Planck collision term is used to study, in cylindrical geometry, a class of dissipative instabilities of which the classical tearing mode is an archetype. Variational solution of the kinetic equation obviates the use of an approximate Ohm's law or adiabatic assumption, as used in previous studies, and it provides a dispersion relation which is uniformly valid for any ratio of wave frequency to collision frequency. One result of using the rigorous collision operator is the prediction of a new instability. This instability, driven by the electron temperature gradient, is predicted to occur under the long mean-free path conditions of present tokamak experiments, and has significant features in common with the kink-like oscillations observed in such experiments. (auth)

14503 NONLINEAR STABILIZATION OF BEAM PLASMA INTERACTIONS BY PARAMETRIC EFFECTS. Papadopoulos, K. (Naval Research Laboratory, Washington, D.C. 20375). Phys. Fluids 18: No. 12, 1769-1777 (Dec 1975).

The nonlinear stabilization of the kinetic stage of electron beam plasma instabilities by parametric effects is investigated. It is found that within a definite range of plasma parameters parametric instabilities induced by the beam generated waves can stabilize the system at a level of wave energy density substantially lower than expected by quasi-linear theory. This occurs because at a certain level of beam-generated plasma waves, the transfer rate of wave energy outside the spectral region in resonance with the beam exceeds the beam plasma instability growth rate. A model of a quasi-steady state for the case of continuous beam injection is proposed. The possibility of utilizing ultrarelativistic electron beams for achieving ignition temperatures in a tokamak is discussed. (auth)

14504 MAGNETOHYDRODYNAMIC STABILITY OF A SHARP BOUNDARY MODEL OF TOKAMAK. Freidberg, J.P. (Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87544); Grossmann, W. Phys. Fluids 18: No. 11, 1494-1506 (Nov 1975).

Calculations of critical β for a sharp boundary, constant pressure model of tokamak are presented. The analysis is valid for arbitrary β, arbitrary aspect ratio, and arbitrary plasma cross section. Specific results are given for the circle, ellipse, triangle, square, and doublet cross sections. (auth)

14505 MHD-STABILITY OF THE SCYLLAC CONFIGURATION. Berge, G.; Freidberg, J. P. (Los Alamos Scientific Lab., NM). pp 3-11 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381-(Vol.3); CONF-741105-P3.

The results of a stability analysis for a diffuse high-beta, l equals 1 helical configuration are presented. It is shown that there exists a gross m equals 1 mode whose properties are quite similar to those predicted by the sharp-boundary model. In addition, two new classes of m equals 1 modes are found, one localized on the inside of the plasma, the other one outside. For any monotonic pressure profile, these modes are unstable although their growth rates are very small. A further study suggests that small changes in the profile may stabilize these modes. (auth)

14506 PLASMA PARAMETERS AND STABILITY OF THE ZT-1 PINCH EXPERIMENT. Baker, D. A.; Burkhardt, L. C.; Di Marco, J. N. (Los Alamos Scientific Lab., NM). pp 35-45 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381-(Vol.3); CONF-741105-P3.

The ZT-1 toroidal z-pinch experiment is designed to produce theoretically predicted MHD-stable equilibria with high-temperature plasmas. The equilibria are characterized by a hollow pressure profile and a strong toroidal stabilizing field inside the plasma; this field is programmed to reverse in the outermost region of the pinch. Experiments have been done with pinch current values of 30 to 200 kA with rise times of 2×10^{10} to 1.5×10^{12} A $\cdot$ s^{-1}. Ion temperature measurements have established the capability of a fast-rising toroidal current to heat ions to kilovolt temperatures. The streak pictures, plasma-density and magnetic-field measurements show that, for intermediate values of current rise-times, the plasma is well-confined, with small particle loss, for 10 to 12 mu s. For this mode of operation, measurements on the plasma and field parameters show that appropriate field programming eliminates early unstable behavior. The rise-times of the poloidal and reversed toroidal fields need to be comparable in order to achieve the desired stable profiles. The electrons are observed to be colder than the ions and the measurements indicate that the stable time is limited by field diffusion. (auth)

14507 GARCHING BELT-PINCH EXPERIMENTS. Becker, G.; Eberhagen, A.; Gruber, O.; Herold, H.; Peiry, J. M.; Roehr, H.; Wilhelm, R.; Zwicker, H. (Max-Planck-Institut fuer Plasmaphysik, Garching, Ger.). pp 47-55 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

In the first experimental step of the 1 MJ Belt Pinch II (without improved shock heating), plasma equilibria close to the theoretical high-β limit could be obtained ($\beta_{pol} \approx$ aspect ratio $\approx 5-8$). Using an appropriate field programming of the vertical field, the corresponding eccentricities b/a could be varied between 4 and 10. Under these conditions, the stability behavior has been studied in the collision-dominated regime for the high-β time scale ($\beta_{pol} \gg 1$) of typically 50–70 μs($n_e \leq 10^{15}$ cm^{-3}, $T_e \approx 20-30$ eV, $\langle\beta_{tot}\rangle \leq 70\%$). The two main results of high-β operation compared with the previous experiments at the small Belt Pinch I ($\beta_{pol} < 1$) are: (1) The stability limit is practically the same ($q \sim 2-2.5$) and depends only weakly on b/a. (2) In the case of unstable modes (at $q < 2$), no m = 1 but much higher m-numbers occur. An interesting variant of the standard Belt Pinch is the new Poloidal Field Belt Pinch which is analogous to the toroidal (stabilized) z-pinch with non-circular cross-section. Its stability behavior was studied in a 100-kJ experiment. In the investigated range of plasma parameters ($n_e \approx 5 \times 10^{15}$ cm^{-3}; $T_e = 15-25$ eV, $\delta = 1-3$ cm) the lifetime of the configuration was generally limited by slowly growing gross deformations, which are most likely exponentially growing resistive m = 0 tearing instabilities. No rotational MHD-modes were observed in the experiment. (auth)

14508 STABILITY AND TOROIDAL EQUILIBRIUM CONDITIONS OF A THETA-PINCH PLASMA IN A MULTIPLE MIRROR FIELD. Itagaki, T.; Karakizawa, T.; Saito, K.; Shiina, S.; Todoroki, J. (Nihon Univ., Tokyo). pp 181-193 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

The stability of corrugated theta-pinch plasma is studied in multiple mirror field, whose periodic length and mirror ratio are 28.8 to 20.4 cm and 1.2 to 8.3, respectively. The plasma produced is stable with respect to the m = 1-mode instability during a time interval longer than the theoretical growth time at any field parameters and any initial gas pressures. The higher-m modes are weakly unstable so that the plasma is deformed, since it is not in contact with the discharge tube wall. Therefore, some stabilizing effects (not only an end effect, but also a dynamical effect) are ex-

pected. Next, a toroidal magnetic configuration with closed magnetic lines generated by the following method is proposed. The multiple mirror field is modified by means of a copper shell, which is placed around the discharge tube and has a longitudinal gap with an angle beyond the critical value. This modified multiple mirror field has a magnetic configuration satisfying the toroidal-equilibrium condition in the closed magnetic line system. As a first step to toroidal confinement, the experiment is performed in linear geometry. It is observed that the plasma column, as a whole, drifts towards the gap side. The plasma drift, which compensates for the toroidal plasma drift, is compared with the theoretical prediction. It is expected that a copper shell plays the role of enhancing the wall stabilization effect and that this method provides easy control of the field configuration. (auth)

14509 PARAMETRIC INSTABILITIES OF PLASMAS IN THE FREQUENCY RANGES ω GREATER THAN OR EQUAL TO ω_{LH} AND $\omega < \omega_{LH}$. Rogister, A.; Hasselberg, G.; Harms, K. D. (Kernforschungsanlage, Juelich, Ger.). pp 309-318 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

Most parametric instabilities considered up to date were described by three-wave resonant decay. The emphasis is laid here on parametric destabilization occurring in plasmon-particle-plasmon scattering (i.e. nonlinear Landau interaction) in the frequency range $\Omega_i < \omega < \omega_{LH}$ and $\omega \gtrsim \omega_{LH}$ (Ω_i = ion gyrofrequency; ω_{LH} = lower hybrid frequency). More specifically, a nonlinear theory of lower hybrid turbulence driven by a whistler pump wave was developed leading to theoretical estimates of (i) the saturation level of the turbulence; (ii) the corresponding anomalous absorption rate of the pump wave; (iii) the plasma heating rate. Numerical evaluations are given for the parameter ranges which are relevant to the present generation of tokamaks and to reactors. The theoretical results are very promising; the technique apparently should only fail at high densities in very large machines [e.g. for $N \gtrsim 3 \times 10^{14}$ cm^{-3} if a (plasma radius) = 200 cm, B = 100 kG, T = 5 keV. This result is, of course, explained by the poor tunnelling of the pump wave through the evanescent region between the plasma vacuum interface and the turning point under those conditions.] The relevance of ion Bernstein turbulence induced by a magneto-acoustic pump wave is also discussed; it is felt that this parametric instability should not be very effective in heating a tokamak plasma. (auth)

14510 NEW LOW-FREQUENCY PARAMETRIC INSTABILITY AND ITS EFFECT ON TOROIDAL PLASMA DIFFUSION. Canobbio, E. (EURATOM-CEA, Grenoble, France). pp 333-343 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

Anomalous plasma cross-field diffusion was observed during the heating phase in various large-power rf experiments including transit time magnetic pumping (TTMP) and ion cyclotron resonance heating (ICRH). The main features of pumpout measured in the TTMP-case and the anomalous plasma behavior observed in the ICRH case seem to indicate a mechanism based on instabilities. The purpose of this paper is to point out a new class of parametric instabilities which exist in the presence of a self-consistent pump wave of frequency $\omega_0 \lesssim \omega_{pi}$ and arbitrary wave number $\vec{K}_0$. This instability involves coupling to a low-frequency ($|\omega| \ll \omega_0$) electrostatic flute-like quasi-mode (a wave which would be strongly ion-Landau damped in the absence of the pump) and to side-band plasma waves ($\omega \pm \omega_0$, $K \pm K_0$). Here, $|K_{||}| \ll K_{||0}$ and $\vec{K}_\perp \simeq \pm 2\vec{K}_{\perp 0}$. The side bands are predominantly electrostatic surface modes in the TTMP frequency range and predominantly electromagnetic surface modes at higher frequencies. With the field amplitudes which are required for plasma heating (typically ≃100 V/cm at the rf structure) the instability criterion can be satisfied at least in the outer plasma shell where usually a substantial electric field develops along $\vec{B}_0$. This instability easily explains the loss level observed in present-day moderate-scale devices. Moreover, it suggests that special attention should be given to the behavior of the plasma edge in any rf heating experiment of thermonuclear interest, even though the resulting degradation of toroidal confinement is expected to become less important in larger devices. (auth)

14511 TOROIDAL PINCH EXPERIMENT IN ETL TPE-1. Ogawa, K.; Kiyama, S.; Maejima, Y. (Agency of Industrial Science and Tech., Tokyo). pp 445-461 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

ETL TPE-1 is an axisymmetric fast toroidal pinch device (B_{zmax} = 20 kG, I_{zpmax} = 100 kA, the minor and major radii of the discharge tube are 5 and 40 cm, respectively) for a hot, high-density plasma confinement in the screw-pinch and reversed-field pinch configurations. In this paper, equilibrium and stability in a screw-pinch configuration in the range of plasma temperature of 100 eV ~ 30 eV are studied experimentally. To obtain a stable pinch plasma, special attention was paid to the following points: (i) the experiments were mainly done in tokamak configurations, $q > 1$, (ii) by changing the bias toroidal magnetic-field, the β_p-value was controlled to obtain adequate toroidal equilibrium, and (iii) from the requirement of MHD-stability, the radial distribution of the q-value was controlled by changing the time duration, δt, between the starts of Z- and θ-pinches. The measured plasma parameters (T_e, T_i, N_e), field configurations and their time histories are described in detail and, in the compression phase, fairly good agreement between the experimental results and those of the computer simulations based on a two-fluid model was obtained. The plasma in the high-β tokamak configurations ($q > 1$, $\beta_p < 1 \sim 2$, $\beta < 0.1$) is obtained for 30 ~ 70 μs and, in these cases, the plasmas are studied thoroughly with respect to heating, equilibrium, stability and the transport characteristics, which might be neo-classical rather than simply classical. (auth)

14512 EXPERIMENT ON STP: AN AXISYMMETRIC FAST TOROIDAL PINCH WITH VERY SMALL ASPECT RATIO. Hirano, K.; Kitagawa, S.; Mimura, M.; Kita, Y.; Ohi, M.; Amano, T.; Wakatani, M. (Nagoya Univ., Japan). pp 463-470 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

A high-β fat tokamak configuration operated under a small q-value is tested. The maximum ion and electron temperatures are 500 and 100 eV, respectively, while a plasma density of about 1×10^{15}/cm^3 is observed. A violent toroidal drift appears after the pinch implosion and a large amount of the plasma energy is lost within 10 μs. However, application of a pulsed vertical field of about 480 G changes this situation dramatically. Movable-magnetic-probe measurements show that, with the vertical field, the plasma pressure at 17.6 μs after the start of the main discharge is 3×10^{17} eV/cm^3, whereas it is very small when no field is excited. Strong signals of the $m = 2$ mode appear when the B_p signal of eight pick-up loops around the minor circumference of the torus is transformed into Fourier components. The $m = 2$ mode becomes small when high-β operation with negative bias field is carried out. It is also observed that the sine component of the $m = 1$ mode appears when the q-value is increased to 2 from 1.3. These phenomena can be explained qualitatively by the theory of Freidberg and Haas. (auth)

Thermonuclear Engineering and Equipment

Refer also to abstracts 14395, 14722, and 15262.

14513 (ANL/CTR-75-3) CTR QUARTERLY PROGRESS REPORT, JULY–SEPTEMBER 1975. (Argonne National Lab., Ill. (USA)). Nov 1975. Contract W-31-109-Eng-38. 97p. Dep. NTIS $6.50.

Research progress conducted during this period is reported for the following general areas: (1) surface studies, (2) materials, (3) tokamak experimental power reactor, (4) engineering technology, and (5) superconducting magnet program. (MOW)

14514 PBNL-20716) IMPLICATIONS OF HIGH EFFICIENCY POWER CYCLES FOR FUSION REACTOR DESIGN. Powell, J. R.; Usher, J.; Salzano, F. J. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 19p. (CONF-751125-137). Dep. NTIS $3.50.

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The implications of the High Efficiency Power Cycle for fusion reactors are examined. The proposed cycle converts most all of the high grade CTR heat input to electricity. A low grade thermal input (T approximately 100°C) is also required, and this can be supplied at low cost geothermal energy at many locations in the U. S. Approximately 3 KW of low grade heat is required per KW of electrical output. The thermodynamics and process features of the proposed cycle are discussed. Its advantages for CTR's are that low Q machines (e.g. driven Tokamaks, mirrors) can operate with

a high (approximately 80 percent) conversion of CTR fusion energy to electricity, where with conventional power cycles no plant output could be achieved with such low Q operation. (auth)

14515 (BNL--20717) LOW ACTIVITY BLANKETS FOR EXPERIMENTAL POWER REACTORS. Benenati, R.; Fillo, J.; Lazareth, O. W.; Majeski, S.; Powell, J. R.; Tichler, P. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 20p. (CONF-751125--134). Dep. NTIS $3.50.

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

Results of current studies aimed at the development of low activity blankets for Tokamak experimental power reactors are presented. First wall loadings in the range of 0.5 to 1.0 MW(th)/m^2 have been assumed. Blanket designs are developed for both circular plasma reactors (R equals 6.25m, a equals 2.1m) and non-circular plasma reactors (R equals 4.0m, a equals 1.0m, b equals 3.0m). For each of these two reactor choices, two blanket options are described. 1) In the first option, the blanket is thick graphite block structure (approximately 50cm thickness) with SAP coolant tubes carrying helium imbedded deep within the graphite to minimize radiation damage. The neutron and gamma energy deposited in the graphite is radiated along internal slots to the coolant tubes where approximately 80 percent of the fusion energy is carried off by He at 380^{0}C. The remaining 20 percent of the fusion energy is removed by a separate He stream at a slightly lower temperature. The maximum graphite surface temperature is relatively low (approximately 1700^{0}C at 1 MW(th)/m2). 2) In the second blanket option, the blanket is composed of aluminum modules. The aluminum shell (5000 series alloy) is maintained at a low temperature (approximately 200^{0}C) by a water coolant stream. Approximately 40 percent of the fusion energy is removed in this circuit. The remaining 60 percent of the fusion energy is deposited in a thermally insulated hot interior (SiC and B_4C) where it is transferred to a separate He coolant, with exit temperature of 700^{0}C. (auth)

14516 (BNL-20726) STRUCTURAL SAFETY FEATURES FOR SUPERCONDUCTING MAGNETS. Lehner, J.; Reich, M.; Powell, J.; Bezler, P.; Gardner, D.; Yu, W.; Chang, T. Y. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 19p. (CONF-751125-133). Dep. NTIS $3.50.

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

A survey has been carried out for various potential structural safety problems of superconducting fusion magnets. These areas include: (1) Stresses due to inhomogeneous temperature distributions in magnets where normal regions have been initiated. (2) Stress distributions and yield forces due to cracks and failed regions. (3) Superconducting magnet response due to seismic excitation. These analyses have been carried out using a variety of large capacity finite element computer codes that allow for the evaluation of stresses in elastic or elastic-plastic zones and around singularities in the magnet structure. Thus far, these analyses have been carried out on UWMAK-I type magnet systems. (auth)

14517 (BNL--20752) SUMMARY OF EXISTING SUPERCONDUCTING MAGNET EXPERIENCE AND ITS RELEVANCE TO THE SAFETY OF FUSION MAGNET. Hsieh, S. Y.; Allinger, J.; Danby, G.; Keane, J.; Powell, J.; Prodell, A. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 6p. (CONF-751125-132). Dep. NTIS $3.50.

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

A comprehensive summary of experience with over twenty superconducting magnet systems has been collected through visits to and discussions about existing facilities including, for example, the bubble chamber magnets at Brookhaven National Laboratory, Argonne National Laboratory and Fermi National Accelerator Laboratory, and the large superconducting spectrometer at Stanford Linear Accelerator Center. This summary includes data relating to parameters of these magnets, magnet protection methods, and operating experiences. The information received is organized and presented in the context of its relevance to the safe operation of future, very large superconducting magnet systems for fusion power plants. (auth)

14518 (CONF-751125-90) FABRICATION OF THE PDX VACUUM VESSEL. Joyce, J. B.; Mullaney, D. H. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). 1975. 4p. Dep. NTIS $3.50.

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The vacuum vessel for PDX is designed to meet the three goals of large volume, simplicity and accessability. A shell of one half inch thick welded 305 stainless steel meets these requirements. The geometry of the tank is that of a stretched torus having a cross sectional shape of a race track. Access to the inside of the tank is available through man sized ports, removal of top or bottom, or separation of the vessel into halves by a joint in the vertical plane. Evacuation is accomplished by either mercury diffusion pumps, backed by rotary mechanical pumps, or liquid Helium Cryo pumping in conjunction with turbomolecular pumps. Both systems are being evaluated. (auth)

14519 (CONF-751125-91) PROPOSED TFTR ELECTRICAL SYSTEM. Bronner, G.; Murray, J. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). 1975. 13p. Dep. NTIS $3.50.

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The development of controlled thermonuclear fusion has progressed to the stage where the present facilities and energy available for future devices are not sufficient and must be increased by about a factor of ten. This report describes the proposed TFTR ac utility power distribution system, an energy storage motor generator flywheel facility, and the rectifier conversion equipment for the Toroidal Field Confining System (TF), Ohmic Heating System (OH), Equilibrium Field System (EF) and the Neutral Beam Heating System (NB). The general requirements are described and the special design considerations identified. (auth)

14520 (CONF-751125-92) PDX MECHANICAL AND COILED SUPPORTS. Knutson, D.; Willard, J.; Bialek, J.; Malick, F. S. (Princeton Univ., N. J. (USA). Plasma Physics Lab.; Westinghouse Research Labs., Pittsburgh, Pa. (USA)). 1975. 3p. Dep. NTIS $3.50.

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The principal function of the Princeton Divertor Experiment (PDX) mechanical structure is to provide support for the toroidal field (TF) and the poloidal field (PF) coil systems. These coil systems are subjected to forces produced by the interaction of their currents with various magnetic fields. The structural components are designed to support the coil systems for gravity loading, operating forces, and forces arising from fault conditions. In addition the mechanical structure supports the vacuum vessel and its internal components. The TF coil support system accounts for most of the structure. The mechanical structure is complicated by the demountable design of the TF coils. The demountable design was adopted to permit easy access for removal or rearrangement of the divertor coils located within the bore of the TF coils. (auth)

14521 (CONF-751125-99) TEST FACILITY FOR PLT TF COILS. Hearney, J.; File, J.; Dreskin, S. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). 1975. 6p. Dep. NTIS $3.50.

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

Past experience with the model C stellerator and other toroidal field devices indicates that mechanical and electrical tests of a toroidal field coil prior to maximum field operation of the device is prudent and desirable. This paper describes a test program for the PLT-TF coils. The test stand consists of one test coil, two background coils and a steel supporting structure. The three coil configuration produces a 67.5 kG field at the inner conductor (38 kG at the bore center) and simulates a 1/R field distribution in the bore of the test coil. The resolution of the field force system and resultant stresses within the test structure are discussed. A test procedure is described which maximizes the information obtained from a 100,000 pulse program. (auth)

14522 (CONF-751125-100) CENTER COLUMN DESIGN OF THE PLT. Citrolo, J.; Frankenberg, J. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). 1975. 3p. Dep. NTIS $3.50.

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The center column of the PLT machine is a secondary support member for the toroidal field coils. Its purpose is to decrease the bending moment at the nose of the coils. The center column design was to have been a stainless steel casting with the toroidal field coils grouped around the casting at installation, trapping it in place. However, the castings developed cracks during fabrication and were unsuitable for use. Installation of the coils proceeded without the center column. It then became necessary to redesign a center column which would be capable of installation with the toroidal field coils in place. The final design consists of three A-286 forgings. This paper discusses the final center column design and the influence that new knowledge, obtained during the power tests, had on the new design. (auth)

14523 (CONF-751125-101) TOROIDAL FIELD COILS FOR THE PDX MACHINE. Bushnell, C. W. (Princeton Univ., N. J.

(USA). Plasma Physics Lab.). 1975. 2p. (CONF-751063-2). Dep. NTIS $3.50.

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

This paper describes the engineering design features of the TF coils for the PDX machine. Included are design details of the electrical insulation, water cooling, and coil segment joint which allows access to the central machine area. A discussion of the problems anticipated in the manufacture and the planned solutions are presented. (auth)

14524 (CONF-751125-102) ANALYSES OF LAMINATED BEAMS FOR USE IN COIL DESIGN. Bialek, J. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). 1975. 13p. Dep. NTIS $3.50.

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

Recent experimental data obtained from PLT has shown that equivalent beam theory is inadequate for predicting the deformation of large circular toroidal field coils. The PLT coils are much more flexible than equivalent beam theory predicts. The latest analyses have shown that shear plays an important role in the deformation of the PLT TF coils. This situation has indicated the need to analyze in explicit detail, the layer to layer behavior of simple laminated structures. The progress made to date in analyzing a laminated beam is summarized. By using variational techniques, the deflections and stresses in each layer of a laminated beam are modeled. To date, reasonable results have been obtained for either deflection or stress separately but a single model that simultaneously gives good agreement for both deflection and stress has not yet been determined. Brief descriptions of the mathematical models used and the results obtained with each are presented. (auth)

14525 (CONF-751125-104) STRESS ANALYSIS OF PLT COIL. Frankenberg, J.; Smith, R. A. (Princeton Univ., N. J. (USA). Plasma Physics Lab.; Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1975. 13p. Dep. NTIS $3.50.

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The toroidal field coils of tokamak devices create a field within the torus whose strength varies inversely with distance from the machine center. This field, crossing the current in the TF coils, creates a magnetic pressure on the coil. The pressure produces a net inward centering force, countered by pressure on the wedge face, and a vertical separating force, causing tensile stress across the horizontal mid-plane. In the past these forces have been analyzed by superposition and beam theory. Because of the size and complexity of the PLT machine it was decided to also initiate a finite element analysis of the coil. This paper describes both methods of analysis. (auth)

14526 (CONF-751125-105) CONCEPTUAL DESIGN OF A DIVERTOR FOR A TOKAMAK EXPERIMENTAL POWER REACTOR. Georgievsky, A. V.; Gralnick, S. L.; Jassby, D. L.; Meade, D. M.; Saksagansky, L. G.; Stephanovsky, A. M.; Tenney, F. H. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). 1975. 7p. Dep. NTIS $3.50.

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

A design for a Double-Null Poloidal Divertor for a Tokamak EPR is presented which allows remote assembly of the torus and utilizes a standard neutral pumping and heat removal system. (auth)

14527 (CONF-751125-117) FAULT PROTECTION FOR NEUTRAL-BEAM INJECTION SYSTEMS. Knauer, R. C.; Ashcroft, D. L.; Murray, J. G.; Newman, R. A. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). 1975. 4p. Dep. NTIS $3.50.

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

This paper concerns the design of a circuit to control the accelerating voltage to a neutral injection gun. An ignitron crowbar is used to dissipate stored energy in the event of an arc-over in the ion gun. (auth)

14528 (CONF-751125-122) ANALYTICAL SOLUTION OF THE TOROIDAL CONSTANT TENSION SOLENOID. Gralnick, S. L.; Tenney, F. H. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). 1975. 5p. Dep. NTIS $3.50.

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The coil shape is determined by requiring that the curvature of the flexible conductor be proportional to the distance from the toroidal axis. The resulting second order differential equation for the coil coordinates can be integrated once but for the second and final integration no closed form has been found and the integration has been done numerically. This solution of this differential equation is analytical in terms of an absolutely and uniformly convergent infinite series. The series converges quite rapidly and in practice ignoring all but the first five terms of the series introduces an error of less than 2 percent. (MOW)

14529 (CONF-751125-125) ENERGY SYSTEM FOR THE GENERATION OF DIVERTOR MAGNETIC FIELDS IN THE PDX FUSION RESEARCH DEVICE. Turitzin, N. M. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). 1975. 6p. Dep. NTIS $3.50.

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

One of the major problems encountered in the development of Tokamak type fusion reactors is the presence of impurities in the plasma. The PDX device is designed to study the operation of poloidal magnetic field divertors and consequent magnetic limiters for controlling and reducing the amount of impurities. A system of coils placed at specific locations produces a required field configuration for the poloidal divertor. This paper describes the system of energy supplies required and the interrelations of field coil currents during plasma current initiation, growth and steady state. (auth)

14530 (CONF-751125-128) PLT BIAS FIELDS AND THEIR CURRENT SUPPLIES. Kloiber, F. W. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). 1975. 6p. Dep. NTIS $3.50.

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

Two mutually perpendicular bias fields provide vernier control over the plasma location in the vacuum chamber. A radially outward horizontal field is generated by a separate set of two bias coils mounted horizontally above and below the vacuum chamber and connected in series opposing. The vertical bias field is generated by superimposing a bias current on the main vertical field or shaping field coils. A forward or aiding bias field is generated by simply programming an incremental forward current into the main shaping field supply. For a reverse bias field, however, a reverse current supply is required which must establish negative bias current in the shaping field coil prior to the plasma formation. After plasma formation, as the plasma current increases and induces a forward voltage in the field coil, the bias current goes to zero. When the coil current goes positive, the reverse bias supply is taken out of the circuit to prevent it from acting as a short circuit across the SF coil. (auth)

14531 (CONF-751125-131) HIGH POWER MODULATOR/REGULATORS FOR NEUTRAL BEAM SOURCES. Lawson, J. Q.; Deitz, A. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). 1975. 10p. Dep. NTIS $3.50.

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

PPPL has recently completed two new Modulator/Regulators for neutral injection sources used on the ATC machine and is constructing four new ones for use with sources on the PLT machine. The ATC modulator uses the well proven 4CX35,000C tetrode as the main switch tube, while the PLT modulators will be using the new but significantly higher powered X-2170 tetrodes. Some interesting circuit and manufacturing techniques are discussed. (MOW)

14532 (CONF-751125-136) ENERGY SPECTRA OF FUSION NEUTRONS FROM PLASMAS DRIVEN BY REACTING ION BEAMS. Towner, H. H.; Jassby, D. L. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). 1975. 5p. Dep. NTIS $3.50.

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

Neutron spectra are calculated for two-component tokamak reactors using appropriate steady-state velocity distributions for fast deuterons. The angle-averaged neutron spectra are shown for D-T and D-T interactions. (MOW)

14533 (ERDA-106) REPORT OF THE AD HOC COMMITTEE ON FUSION PLASMA RESEARCH FACILITIES. (Energy Research and Development Administration, Washington, D. C. (USA)). [nd]. 36p. Dep. NTIS $4.00.

This report surveys the need for Fusion Plasma Research Facilities (FPRF) in advancing research in several areas of plasma and atomic physics that are essential to the CTR program and describes several device options for FPRF's. The major conclusions of the report are that there is an urgent need to provide such facilities and that the most significant contributions to CTR that would be made through these facilities are in the development of plasma diagnostics and measurements of atomic processes. (auth)

14534 (ERDA-tr-86, pp 1-16) AVAILABILITY OF SUPERCONDUCTING TECHNOLOGY FOR FUSION RESEARCH. Koma-

rek, P. (Institute for Experimental Nuclear Physics, Karlsruhe, Ger.). Jan 1975. Translated from German Report.

In reports of the Nuclear Research Center, Karlsruhe. 7th annual publication.

The magnet system for the tokamak is described with respect to plasma confinement, diverters, and the coil system. Dimensioning of the poloidal and toroidal field coils is discussed. The design of a superconducting coil for energy storage is given. (MOW)

14535 (GA-A-13668) STRESS ANALYSIS OF DOUBLET III TOROIDAL COIL. Reis, E. E.; Charman, C. M.; Feuerbacher, R. L.; Puhn, F. A.; Wesley, J. C. (General Atomic Co., San Diego, Calif. (USA)). 3 Oct 1975. Contract E(04-3)-167. 18p. Dep. NTIS $3.50.

The toroidal field coil (B-coil) in the Doublet III Tokamak consists of 144 turns, each carrying 195 kA, grouped in 24 bundles of six turns each. The bundles are collectively bonded together near the toroid centerline to form one composite centerpost. The results of the stress analysis of the B-coil show that it is structurally adequate for 100,000 cycles of operation under loading conditions produced by a 40 kG toroidal field. (auth)

14536 (GA-A-13687) DESIGN OF DEMOUNTABLE JOINT FOR DOUBLET III TOROIDAL FIELD COIL. Puhn, F. A.; Callis, R. W.; Jones, J. D.; Reis, E. E.; Wesley, J. C. (General Atomic Co., San Diego, Calif. (USA)). 3 Oct 1975. Contract E(04-3)-167. 13p. (CONF-751125-121). Dep. NTIS $3.50.

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The design criteria for General Atomic Company's Doublet III Tokamak specifies a demountable joint at the top of the toroidal field coil (B-coil). This joint allows assembly of the vacuum vessel, electric field coils (E-coils), field-shaping coils (F-coils), and supporting structure without any joints in these components. The overall design and assembly sequence of Doublet III is therefore critically dependent on proper functioning of the B-coil demountable joint. The selected interlocking finger design incorporates sufficient strength and electrical conductivity to permit operation at a toroidal field of up to 40 kG for 10^5 cycles with an adequate margin of safety. The finger joint can be manufactured using standard machining tolerances and procedures and can be assembled and disassembled with relative ease and rapidity. (auth)

14537 (IFA-FR-137-1975) APPLICATION OF COMPUTATION PROGRAM DSTD TO THE THERMONUCLEAR PLASMA SIZE FOR THE THERMONUCLEAR REACTOR CONTROLLED BY THE RATE OF THE FISSION REACTION. I. Cristea, G. (Institutul de Fizica Atomica, Bucharest (Romania)). 1975. 27p. Dep. NTIS (US Sales Only) $4.00.

The DSTD program was used for the study of few models of a thermonuclear plasma specific to the hybrid thermonuclear reactor. Graphics show the space distribution of the temperature and density of the thermonuclear plasma. Particular attention is paid to the quantities that characterize the thermonuclear plasma when it neighbors its surrounding cold plasma. The variation of these quantities corresponding to various forms of the thermonuclear plasma is shown. (auth)

14538 (INIS-mf-1842) INSTITUTE FOR ELECTROMAGNETIC FIELD THEORY AND PLASMA PHYSICS ANNUAL REPORT, 1974. (Chalmers Tekniska Hoegskola, Goeteborg (Sweden). School of Electrical Engineering). 1975. 31p. INIS.

The research carried out at the Institute for Electromagnetic Field Theory and Plasma Physics in Göteborg has been devoted, during the year 1974, to problems related to the basic aspects of nonlinear interactions in plasmas as well as to work oriented towards the applications. Several new results contributing essentially to the field of basic nonlinear theory as well as to its application in the area of laser-fusion research were obtained. Results were obtained concerning the influence of deviation from laser coherence on the efficiency of the non-linear couplings, e.g. the Stimulated Raman and Brillouin Scattering in the laser-fusion problem. By a suitable detuning of the laser radiation the undesired anomalous reflexion may become appreciably lowered. Future research is planned in the following areas: (i) Laser induced fusion, active research, survey (ii) Electron beam induced fusion; active research, survey (iii) Reactor-development studies, laser-plasma, Tokamak etc. (iv) Turbulence- and anomalous effects; Heating of plasma (v) Nonlinear effects in plasma; studies of basic problems; fluctuations in plasma (vi) Stochastic processes and coherence in plasma (vii) Analysis of diagnostic processes. (auth)

14539 (IRS-T-27, pp 5-18) FUSION REACTOR: A CHANCE FOR SOLUTION OF THE ENERGY PROBLEMS. Wienecke, R. (Max-Planck-Institut fuer Plasmaphysik, Garching, Ger.). Apr 1975. (In German).

From meeting on protection of nuclear power plants from external impacts; Cologne, F. R. Germany (30 Oct 1974).

In technical meeting on protection of nuclear power plants against external influences.

The special difficulties in the development of controlled nuclear fusion are reviewed. The physical principles of fusion and the properties of a plasma are summarized. The principles of the three primary approaches to the development of fusion reactors (high β experiment, Tokamak and stellarator, and laser fusion) and the basic technology are described. The advantages of fusion reactors are tabulated. (JSR)

14540 (MATT-1192) MAXIMUM NEUTRON WALL LOADINGS IN BEAM-DRIVEN TOKAMAK REACTORS. Jassby, D. L.; Towner, H. H. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). Jan 1976. Contract E(11-1)-3073. 13p. Dep. NTIS $4.00.

If a beam-driven D-T tokamak reactor is operated at the maximum density allowed both by pressure limitation and by adequate neutral-beam penetration, the 14-MeV neutron wall loading increases approximately linearly with magnetic field or vertical elongation of the plasma. With elongation equals 3, B/sub tmax/ equals 15 T, W/sub beam/ equals 200 keV, Q approximately 1.0, maximum wall loading is about 5 MW/m^2. (auth)

14541 (MATT-1193) PULSED GAS LOAD PUMPING OF HYDROGEN BY VAPOR DEPOSITED TITANIUM FILMS. Martin, G. D. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). Jan 1976. Contract E(11-1)-3073. 30p. (CONF-751125-135). Dep. NTIS $4.00.

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The Princeton Poloidal Divertor Experiment (PDX) plans to use titanium gettering of hydrogen to provide the high pumping speeds required to capture the pulsed gas load which occurs in the region where the diverted plasma is neutralized. Detailed information with respect to hydrogen titanium film interactions under similar conditions was sought so that engineering decisions could be made with greater confidence. Pumping speeds for hydrogen on titanium films were determined by admitting a pulse of gas into the volume enclosed by the substrate and measuring the time constant of the pressure decay. The measurement was made periodically as the film was deposited, and when the maximum sticking coefficient was reached, sublimation was stopped and additional gas pulses admitted to determine the speed vs. hydrogen concentration in the Ti film. The amount of gas per pulse varied from 0.25 to 5 monolayers. Atomic hydrogen produced by thermal dissociation in a continuous measurement gave minimum-values for the sticking coefficient of 0.3 for a room temperature film. A summary of results is shown. Titanium film peeling tests were performed and sublimation sources were test operated. (auth)

14542 (MATT--1197) ANALYTIC SOLUTIONS FOR CONSTANT TENSION COIL SHAPES. Gralnick, S. L.; Tenney, F. H. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). Jan 1976. Contract E(11-1)-3073. 30p. Dep. NTIS $4.00.

An analytical solution of the differential equation describing the shape of a flexible filamentary conductor (incapable of supporting bending stresses) in a toroidal magnetic field has been obtained. The solution derives from a series expansion of modified Bessel functions of integer order. The characteristics of toroidal field magnets for proposed tokamak devices are obtainable by term by term integration of the solution series. General expressions are given for the following coil characteristics: the conductor turn length, the solenoid inductance, the area enclosed by the coil and the coil support dimensions. For several particular cases of interest these coil characteristics are obtained as closed form analytical formula. (auth)

14543 (MLM--2292) TRITIUM INTERACTIONS OF POTENTIAL IMPORTANCE TO FUSION REACTOR SYSTEMS: TECHNOLOGY REQUIREMENTS. Wilkes, W. R. (Mound Lab., Miamisburg, Ohio (USA)). 15 Jan 1976. Contract E-33-1-Gen-53. 18p. Dep. NTIS $4.00.

The tritium technology requirements created by the controlled thermonuclear research program to develop a demonstration fusion power reactor by the year 2000 are reviewed. It is found that the majority of the technological advances which are needed to ensure adequate tritium containment in a tritium breeding power reactor need to be demonstrated on a pilot scale by approximately 1983, so that they may be incorporated into EPR-II, the second of two planned experimental power reactors. The most important advances include development of containment materials with permeabilities to tritium well below measured values for stainless steel; large scale, low inventory deuterium-tritium separation systems; and improved monitoring and assay systems. There are less critical requirements for information about the effects of tritium and helium on the mechanical properties of materials, the

effects of tritium on biological systems, and data on physical and chemical properties of tritium. Substantial progress needs to be made on these problems early enough to permit possible solutions to be tested on EPR-I. In addition, major improvements in tritium handling equipment are required for EPR-I. Those technological problems for which solutions have not yet been demonstrated by EPR-II must be solved by 1989 if they are to be assured successful application in the demonstration reactor. (auth)

14544 (NP-20590) ANNUAL REPORT, 1974. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)) 1974. 141p. (In German). Dep. NTIS (US Sales Only) $10.25.

The following topics were studied: (1) high-β plasma, (2) low-β plasma, (3) tokamaks, (4) laser fusion and wave heating, (5) plasma-wall interactions, (6) computer related research, (7) relativistic plasma-electron ring accelerator experiment, and (8) fusion technology. (MOW)

14545 (ORNL-TM--5080) SCOPING STUDIES OF TRITIUM HANDLING IN A TOKAMAK EXPERIMENTAL POWER REACTOR. Watson, J. S.; Cherdack, R.; Clinton, S. D.; Fisher, P. W. (Oak Ridge National Lab., Tenn. (USA)). Jan 1976. Contract W-7405-eng-26. 50p. Dep. NTIS $5.50.

Tritium handling techniques in an experimental fusion power reactor (EPR) are evaluated to determine the requirements of the system and to compare different equipment and techniques for meeting those requirements. Tritium process equipment is needed (1) to evacuate and maintain a vacuum in the plasma vessel and the neutral beam injectors, (2) to purify and recycle tritium and deuterium for the plasma fuel cycle, (3) to recover tritium from experimental breeding modules, and (4) to provide tritium containment and atmospheric cleanup. A development program is outlined to develop and demonstrate the required techniques and equipment and to permit confident design of an EPR for operation by the mid-1980s. (auth)

14546 (SAND--75-5766) STUDY OF REB TARGET IRRADIATION, DEPOSITION, AND IMPLOSION. Chang, J.; Mix, L. P.; Perry, F. C.; Widner, M. M.; Poukey, J. W. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1975. 32p. (CONF-751108--20). Dep. NTIS $4.00.

From first international topical conference on electron beam research and technology; Albuquerque, New Mexico, USA (3 Nov 1975).

Flat targets, spheres, and hemispheres were irradiated with intense REB (approximately 10^{11} W/cm^2) from the Hydra machine to study target loading, ablation, and implosion. A wide variety of experimental techniques were used in these studies including x-ray pinhole photography, laser holography, laser velocimetry, and flash x-radiography. The energy absorption mechanism was found to be consistent with classical electron deposition. Variations in target loading and implosion symmetry have been observed and, in particular symmetry of loading can be altered by changing the cathode geometry and anode-cathode spacing. (auth)

14547 (STI/PUB-381(Vol.3)) PLASMA PHYSICS AND CONTROLLED NUCLEAR FUSION RESEARCH. Volume III. Proceedings Series. Proceedings of the Fifth International Conference Held in Tokyo, Japan, November 11–15, 1974. (International Atomic Energy Agency, Vienna (Austria)). Oct 1975. 722p. (In Several Languages). (CONF-741105-P3). IAEA $44.00.

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

Separate abstracts for the 56 included papers appear in NSA. Abstracts for 22 of the papers appear in ERDA Research Abstracts. (MOW)

For abstracts of individual papers see: 14389–14409, 14420, 14434, 14447–14450, 14475–14477, 14479, 14505–14512, and 14570–14586.

14548 (TRITA-EPP-75-08) IMPERMEABLE PLASMA TARGETS FOR FUSION REACTIONS. Lehnert, B. (Kungliga Tekniska Hoegskolan, Stockholm (Sweden). Institutionen foer Plasmafysik med Fusionsforskning). 2 May 1975. 14p. Dep. NTIS (US Sales Only) $3.50.

Fully ionized quasi-steady impermeable plasmas can be created and sustained by the technique of rotating plasmas and similar methods, at ion densities being at least two orders of magnitude larger than those of present Tokamak experiments. Such plasmas become suitable targets for energetic ion beams producing nuclear fusion reactions. Even if these target systems are unlikely to become self-sustained fusion reactors, they may provide powerful neutron sources as well as means for fusion-fission hybrid reactors. (auth)

14549 (UCCND-CSD-INF--56) MAGNETIC FIELD OF A FLAT COIL OF RECTANGULAR CROSS SECTION AND ARBITRARILY SHAPED BORDER. Whitson, J. C.; van Rij, W. I.; Clark, B. A. (Oak Ridge National Lab., Tenn. (USA)). Jan 1976. Contract W-7405-eng-26. 19p. Dep. NTIS $5.00.

A subroutine was written that calculates the magnetic field due to current flowing in a coil of finite rectangular cross-section. The coil lies in a plane and may take any shape except one where a multivalued function is necessary to describe the path of the current. (auth)

14550 (UCID-16985) SOME CONSIDERATIONS IN THE DESIGN OF A VENETIAN BLIND DIRECT CONVERTER. Barr, W. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 15 Dec 1975. Contract W-7405-Eng-48. 10p. Dep. NTIS $3.50.

The structural design of a Venetian Blind direct converter will depend on the choice, for example, of: 1) Expander field, (2) Selective leakage, (3) Number of collector stages, (4) Method of cooling and (5) The general configuration and orientation. This note is intended to outline the major compromises that will result from the variation of parameters to fit a particular design. The relationships given are for a two-stage unit, but it is straightforward to extend them to multiple-stage units. (auth)

14551 (UCRL-75605) METHOD FOR ACHIEVING COMPLETE NEUTRALIZATION OF A HIGH-ENERGY CHARGED PARTICLE BEAM. Beal, J. W.; Neil, V. K. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 3 Apr 1974. 15p. Dep. NTIS $3.50.

Several concepts of a controlled fusion reactor utilize a beam of neutral atoms with kinetic energy in the range of 200 keV. Presently existing beams in the range of 10 to 20 keV are converted to neutral beams with an efficiency of like 85 percent via the electron capture mechanism. At 200 keV this conversion efficiency drops to like 20 percent because of the rapidly decreasing electron capture cross-section with increasing beam energy. This note suggests recycling the charged beam back through the neutralizer cell while continually removing the neutralized particles thus improving the overall efficiency. In principal, this recycling can be accomplished by a properly designed magnetic guide field. (auth)

14552 (UCRL-77139) COMPARISON OF LASNEX CALCULATIONS WITH EXPERIMENTAL RESULTS OF PARYLENE DISC IRRADIATIONS AT 1.06 mu m. Mead, W. C.; Kruer, W. L.; Lindl, J. D.; Shay, H. D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 6 Nov 1975. Contract W-7405-Eng-48. 16p. (CONF-751130-14). Dep. NTIS $3.50.

From ASP meeting; St. Petersburg, Florida, USA (10 Nov 1975).

Calculations are discussed using the 2D Lagrangian code LASNEX to simulate irradiation of Parylene discs. Using a representation of the experimental beam profile, geometric optics propagation, and an absorption model based on plasma simulations, the scattered light angular intensity distribution can be obtained. The use of a suprathermal electron heating spectrum and thermally generated magnetic fields with Braginskii transport coefficients leads to agreement with time-integrated x-ray spectra and x-ray spatial distributions. Details of the calculations and comparisons with other models are discussed. (auth)

14553 THE USE OF LASERS TO COMPRESS MATTER. Billon, D.; Cognard, D.; Launspach, J.; Patou, D.; Redon, D.; Rocchiccioli, J. L.; Schirmann, D. (CEA Centre d'Etudes de Limeil, 94-Villeneuve-Saint-Georges (France)). Bull. Inf. Sci. Tech. (Paris); No. 204, 33-45(Jun 1975). (In French)

On account of great progress realized in the technology of powerful lasers during recent years, it will be possible at some future date, to use them to implode small targets of fusible materials, and to produce thermonuclear controlled fusion. Through experiments carried out at Limeil, it is shown that laser energy can produce great pressures in solids. Particularly, the focusing of several laser beams on a target produces inside it a convergent shock wave. (FR)

14554 LASER BEAM—MATTER INTERACTION. Couturaud, J. C.; Decroisette, M.; Faure, C.; Griesemann, J.; Jacquet, L.; Martineau, J.; Meyer, B.; Patou, C.; Rabeau, M.; Saleres, A. (CEA Centre d'Etudes de Limeil, 94-Villeneuve-Saint-Georges (France)). Bull. Inf. Sci. Tech. (Paris); No. 204, 17-31(Jun 1975). (In French)

A synthesis of the physics of the laser-matter interaction at 1.06μm as well as 10.6μm is presented for incident laser fluxes ranging from 10^{10} to 10^{15} W/cm^2. The plasma characteristics are discussed through the main important results which in particular evidence non linear phenomena. The absorption mechanism are studied particularly. Emphasis is put on the transfer energy problem taking into account the importance of this efficiency for implosion experiments. (FR)

14555 FUNDAMENTAL LIMITATIONS AND TOPOLOGICAL CONSIDERATIONS FOR FAST DISCHARGE HOMOPOLAR MACHINES. Driga, M. D.; Nasar, S. A.; Rylander, H. G. (Univ. of Texas, Austin). IEEE Trans. Plasma Sci.; PS-3: No. 4, 209-215(Dec 1975).

Fusion research experiments require high energy short duration pulses. A homopolar machine, as an inertial energy storage system, offers an attractive source of energy meeting these requirements. The Energy Storage Group at the University of Texas at Austin has investigated the fundamental limitations to the discharge time of homopolar machines of various topological configurations. This paper presents a mathematical model for fast discharge homopolar machines. Based on this model, various machine configurations are analyzed. A new configuration—the spool type machine—is also discussed, criteria for the evaluation of different alternatives are presented, and it is concluded that highly efficient (approximately equal to 95 percent), high energy (approximately equal to gigajoules), fast-discharge (approximately equal to 5 to 30 milliseconds) homopolar inertial energy storage systems are technically feasible. Brief reference is also made to some of the experimental results obtained from the existing laboratory models. (auth)

14556 FUSION REACTOR PHYSICS: PRINCIPLES AND TECHNOLOGY. Kammash, T. Ann Arbor, MI; Ann Arbor Science Publishers, Inc. (1975). 506p. $29.50.

Questions regarding the feasibility of fusion power are examined, taking into account fuel cycles and breeding reactions, energy balance and reactor conditions, approaches to fusion, magnetic confinement, magnetohydrodynamic instabilities, microinstabilities, and the main technological problems which have to be solved. Basic processes and balances in fusion reactors are considered along with some aspects of the neutronics in fusion reactors, the physics of neutral beam heating, plasma heating by relativistic electrons, radiofrequency heating of fusion plasmas, adiabatic compression and ignition of fusion reactors, dynamics and control of fusion reactors, and aspects of thermal efficiency and waste heat. Attention is also given to fission-fusion hybrid systems, inertial-confinement fusion systems, the radiological aspects of fusion reactors, design considerations of fusion reactors, and a comparative study of the approaches to fusion power. (IAA)

14557 URANIUM-238 TO URANIUM-235 FISSION-RATIO DISTRIBUTION IN SPHERICAL LITHIUM-METAL ASSEMBLIES WITH AND WITHOUT A GRAPHITE REFLECTOR. Maekawa, H. (Japan Atomic Energy Research Inst., Tokai); Seki, Y.; Hiraoka, T.; Moriyama, M. Nucl. Sci. Eng.; 57: No. 4, 335-340(Aug 1975).

Spherical lithium-metal assemblies with and without a graphite reflector were prepared by stacking lithium and graphite blocks to investigate the neutronics in the fusion reactor blanket. The ratio of ^{238}U-to-^{235}U fission rates was measured by micro-fission chambers. The fission ratio was calculated by the one-dimensional transport code ANISN with the P_5-S_8 approximation using a 42-group neutron cross-section set. The fission ratios measured in the lithium-metal assembly without a graphite reflector agree well with the calculated ones. In the assembly with a graphite reflector, however, there is a large discrepancy between experiment and calculation. (auth)

14558 METHOD AND SYSTEM OF NUCLEAR ENERGY GENERATION. Wilke, W. German(FRG) Patent 2,353,671/A/. 7 May 1975. 11p. (In German)

The method is based on the nuclear reaction $Li^6(n,\alpha)H^3$. Thermal neutrons, whose generations require a power reactor, are fed to a lithium deuterite target in such a manner that part of the tritons produced in this reaction undergo nuclear fusion of the kind $d(T,n)\alpha$ with the deuterons of the target. The remaining tritons are reacted with additional deuterons. The tritium produced in this reaction is processed and fed back to the lithium target over a triton source. It is also possible to process the tritium to a target, feed deuterons to it, and in addition to give the neutrons produced from the $T(d,n)\alpha$ reaction after slowing down to thermal energy to the lithium target. (GE)

14559 FUSION REACTOR. Genswein, A.; Genswein, A. German(FRG) Patent 2,346,819/A/. 27 Mar 1975. 7p. (In German)

The fusion reactor plans a reaction chamber which is penetrated by a magnetic field. The field is to have an increasing density in an outward direction whereas the inside of the reaction chamber of the shape of a rotation symmetrical astroid is completely free from magnetic fields and forms the reaction zone. The magnetic fields are produced by short-circuited, superconducting deflecting coils. Heating takes place via a plasma ring accelerator or a pump coil. The wall material of the chamber can be of lithium or graphite. (GE)

14560 DIE THERMONUKLEARE FUSION–IHRE AUSSICHTEN, PROBLEME UND FORTSCHRITTE–INNERHALB DER EUROPAEISCHEN GEMEINSCHAFT. (Thermonuclear Fusion–Prospects, Problems and Improvements–Within the European Communities). Palumbo, D. Rheinisch-Westfaelische Akademie der Wissenschaften. Opladen, F. R. Germany; Westdt. Verl. (1973). 19p. (In German)

6 refs.

The nuclear fusion reactions concerned, the production of tritium, the advantages and problems of nuclear fusion under terrestrial conditions and the physical aspects of the confinement of a fusion plasma are dealt with, and the design of the future D-T reactor is outlined. Finally, the organization, the fields of activity, and the task projects of the EC research facilities working on the problem of nuclear fusion are discussed. (GE)

14561 PROGRESS IN LASERS AND LASER FUSION. Conference Held in Coral Gables, Florida, January 20–24, 1975. Perlmutter, A.; Widmayer, S. M. (eds.). Studies in the Natural Sciences, Volume 8. New York; Plenum Press (1975). 416p. (CONF-750110–P2). $35.00.

From orbis scientist meeting; Coral Gables, Florida, USA (21 Jan 1975).

Separate abstracts were prepared for the eleven papers. (MOW)

For abstracts of individual papers see: 14381, 14497, 14562–14565, and 14722–14726.

14562 EXPERIMENTS IN LASER FUSION. Hofstadter, R. (Stanford Univ., CA). pp 71-104 of Progress in Lasers and Laser Fusion. Perlmutter, A. (ed.). New York; Plenum Press (1975).

From Orbis scientist meeting; Coral Gables, Florida, USA (21 Jan 1975). See CONF-750110-P2.

Experiments are described that directly observe laser heating, target compression, and hydrodynamic heating. The observed neutron production is correlated with compressed targets and is consistent with core temperatures of 0.5 to 0.7 keV. These results substantially confirm some of the basic concepts of laser-driven fusion and provide strong encouragement to extend the experiments to higher laser energies and a larger class of fusion targets. (MOW)

14563 OUTLOOK FOR LASER FUSION. Nuckolls, J. H. (Lawrence Livermore Lab., CA). pp 105-116 of Progress in Lasers and Laser Fusion. Perlmutter, A. (ed.). New York; Plenum Press (1975).

From Orbis scientist meeting; Coral Gables, Florida, USA (21 Jan 1975). See CONF-750110-P2.

A brief overview of the laser fusion program is given. The discussion covers significant results in the research program. (MOW)

14564 SCATTERED RADIATION AND NEUTRON PRODUCTION IN LASER-PLASMA INTERACTION. Mascheroni, P. L. (Univ. of Texas, Austin). pp 281-308 of Progress in Lasers and Laser Fusion. Perlmutter, A. (ed.). New York; Plenum Press (1975).

From Orbis scientist meeting; Coral Gables, Florida, USA (21 Jan 1975). See CONF-750110-P2.

A theoretical study of the nonlinear and parametric interaction processes taking place during laser implosion of a deuterium-tritium microsphere is given. (MOW)

14565 THEORY OF POWERFUL LASER LIGHT PROPAGATION IN A MATERIAL MEDIUM. Lugovoi, V. N.; Prokhorov, A. M. (Lebedev Inst. of Physics, Moscow). pp 309-407 of Progress in Lasers and Laser Fusion. pp 309-407 of Progress in Lasers and Laser Fusion. Perlmutter, A. (ed.). New York; Plenum Press (1975).

From Orbis scientist meeting; Coral Gables, Florida, USA (21 Jan 1975). See CONF-750110-P2.

A multifoci picture is given that provides a consistent theory of high-power laser propagation in Kerr nonlinearity media and leads to the concept of moving foci. The theory is based on the Maxwell equations. (MOW)

14566 MEASUREMENT OF THE DEVELOPMENT AND EVOLUTION OF SHOCK WAVES IN A LASER-INDUCED GAS BREAKDOWN PLASMA. Chu, T.K.; Johnson, L.C. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08540). Phys. Fluids 18: No. 11, 1460-1466 (Nov 1975).

Space- and time-resolved interferometric measurements of electron density in CO_2-laser produced plasmas in helium or hydrogen are made near the laser focal spot. Immediately after breakdown, a rapidly growing region of approximately uniform plasma density appears at the focal spot. After a few tens of nanoseconds, shock waves are formed, propagating both transverse and parallel to the incident laser beam direction. Behind the transverse propagating shock is an on-axis density minimum, which results in laser-beam self-trapping. The shock wave

propagating toward the focusing lens effectively shields the interior plasma from the incident beam because the lower plasma temperature and higher plasma density in the shock allow strong absorption of the incident beam energy. By arranging the laser radiation-plasma interaction to begin at a plasma-vacuum interface at the exit of a free-expansion jet, this backward propagating shock wave is eliminated, thus permitting efficient energy deposition in the plasma interior. (auth)

14567 LASER TARGET MODEL. Colombant, D.G.; Whitney, K.G.; Tidman, D.A. (Science Applications, Inc., McLean, Virginia 22101); Winsor, N.K.; Davis, J. Phys. Fluids 18: No. 12, 1687-1697 (Dec 1975).

A numerical simulation model is described for the dense hot plasma produced in the interaction of a focused laser pulse with a target of moderate atomic weight. Specific results are given for the line and continuum x-ray emission, together with other parameters of the plasma, for the case of an aluminum target. (auth)

14568 THERMALLY GENERATED MAGNETIC FIELDS IN LASER-DRIVEN COMPRESSIONS AND EXPLOSIONS. Tidman, D.A. (Institute for Fluid Dynamics and Applied Mathematics, University of Maryland, College Park, Maryland 20742). Phys. Fluids 18: No. 11, 1454-1459 (Nov 1975).

The evolution of thermally generated magnetic fields in a plasma undergoing a nearly spherically symmetric adiabatic compression or expansion is calculated. The analysis is applied to obtain approximate results for the development of magnetic fields in a laser-driven compression and explosion of a pellet of nuclear fuel. Localized sources such as those occurring at composition boundaries in structured pellets or at shock fronts give stronger fields than those deriving from smoothly distributed asymmetries. Although these fields may approach 10^7 G in the late stages of compression, this is not expected to present difficulties for the compression process. Assuming ignition of a nuclear explosion occurs, the sources become much stronger and values of $\simeq 10^{10}$ G are obtained at tamper boundaries assuming a 20% departure from spherical symmetry during the explosion. (auth)

14569 PLASMA PRODUCTION FROM SOLID TARGETS WITH LASER RADIATION PREPULSES. Parbhakar, K.J.; Nguyen, D. (Institut National de la Recherche Scientifique, Centre de l'Energie, Université du Québec, Varennes, Québec, Caisse Postale 1020, Canada). Phys. Fluids 18: No. 11, 1588-1589 (Nov 1975).

Plasma production from solid targets by prepulses is discussed. The influence of the time interval between the prepulses and the giant pulse on the density distribution is considered. (auth)

14570 GARCHING TOROIDAL HIGH-BETA STELLARATOR EXPERIMENTS. Braun, W.; Correa, D.; Engelhardt, W. (Max-Planck-Institut fuer Plasmaphysik, Garching, Ger.). pp 25-33 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

A review of the Garching high-beta stellarator program is given. These toroidal l = 1 configurations are being investigated as a continuation of the Garching theta-pinch research program. After linear pre-experiments, Isar T1 was put into operation as the first complete high-beta stellarator torus. The main result of this experiment was the attainment of the intended high-beta M- and S-like equilibrium. The confinement was destroyed by long-wavelength m = 1-modes ($\gamma \approx 5 \times 10^5\ s^{-1}$ at $T_e \approx T_i \approx 100$ eV, $\beta \approx 0.7$). With the high adiabatic compression and the high compression ratio of this experiment ($\kappa = 5 - 10$), this unstable behavior is in agreement with the theoretical predictions. A new experiment is, therefore, proposed in which the m = 1-mode will be wall-stablized ($\kappa \approx 2.5$, 16-m major diameter, 20-cm minor coil diameter, density $\approx 10^{15}\ cm^{-3}$, $T_i \approx T_e \approx 600$ eV). A 1-m segment of this configuration is investigated in a separate linear device, Isar II. With the fast rise of the magnetic field (≈500 ns rise-time), i.e. with shock heating only, a low compression ratio ($\kappa \approx 2.5$) was obtained with a low neutral background. For the parallel technical preparation of the proposed experiment, a 1-m segment of the fast bank (rise-time <500 ns, $B_{max} \approx 0.7$ torr) is being built, the technical feasibility of which has been shown. Theoretical activities were concentrated on helical equilibria with a continuous pressure profile and finite helical distortion. The stability was investigated on the magnetic axis using necessary and sufficient criteria. A helical high-β plasma with a slightly D-shaped cross-section seems to be the most favorable configuration. (auth)

14571 PROGRESS ON CO_2 LASER GAS FUSION. Vlases, G. C. (Univ. of Washington, Seattle); Rutkowski, H.; Hertzberg, A. pp 197-206 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381-(Vol.3); CONF-741105-P3.

Experimental and theoretical investigations were carried out on the interaction of CO_2-laser radiation with underdense plasma (10^{17} to $5 \times 10^{18}\ cm^3$) in strong magnetic fields with the aim of determining feasibility of this approach to CTR. The efforts of three groups, University of Washington–Mathematical Sciences, MIT–Avco, and Princeton are reported. The experiments show that the theoretically predicted self-focusing of the beam in the plasma is effective. Shock waves and bleaching waves have been observed. Theoretical calculations of thermonuclear yields show that large gains are possible from this type of reactor. (auth)

14572 SELF-FOCUSING AND FILAMENTATION OF LASER LIGHT IN PLASMAS. Lee, Y. C. (Univ. of California, Los Angeles); Liu, C. S.; Chen, H. H.; Nishikawa, K. pp 207-215 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381-(Vol.3); CONF-741105-P3.

The diffraction threshold and focal length of a self-focusing laser beam in plasma are derived. A self-similar solution is obtained to describe analytically the spatial structure of the self-focusing process. The filamentation instability is also discussed with the effect of plasma inhomogeneity included. (auth)

14573 EXPERIMENTAL RESULTS OF THE SCREW-PINCH EXPERIMENT SPICA. Bobeldijk, C.; van Heijningen, R. J. J.; Hoekzema, J. A.; Kooyman, W.; van der Laan, P. C. T.; Maris, D. J.; Oepts, D.; Oomens, A. A. M. (FOM Instituit voor Plasmafysica, Rijnhuizen, Netherlands). pp 409-416 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

SPICA is a large toroidal screw-pinch device with torus dimensions R = 60 cm, r = 20 cm. The device has been designed to test earlier predictions that a screw pinch can be stable and in equilibrium up to β values of 20% at q-values of 0.75 and 1.4. These tests can be carried out at higher temperatures and during longer times than was possible in previous machines. The design of SPICA is such that the force-free currents in the outside region can flow for a long time. The decay times of the primary circuits are 1.2 ms for I_θ and 2.1 ms for I_z. The experiments have not yet been done under ideal conditions, the main reason being the low value of the bias field which leads to a β which is too high for stability. Also the base pressure and the correction for the stray fields in the gap region have not been optimized yet. Under these conditions one finds 1/e-decay times of the plasma current of a few hundred μs. The equilibrium behavior of the main plasma column is very good. Stability is still poor, as expected, but improves with increasing bias field. Theoretical analysis shows that the equilibrium position is little affected by loss of current in a wide plasma layer near the wall. The high amplitude of the longitudinal plasma current (up to 400 kA) shows that the force-free currents in the outside region are induced. Current densities are approximately 280 A/cm^2 for $q_{wall} = 1.4$. (auth)

14574 REVERSE-FIELD-PINCH EXPERIMENTS IN THE ETA-BETA DEVICE. Buffa, A.; Costa, S.; Fellin, L. (Univ., Padua). pp 431-443 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

The paper refers to Reverse-Field-Pinch configurations produced on the Padua ETA-BETA device by two different field programmings: the first, as usual, employs an axial field B_{z0} and two fast circuits for the I_z-current and the reversed B_z-field; the second relies on the use of just the two fast circuits for B_z and I_z, the latter being delayed about one quarter period with respect to the former. Both modes lead to R.F.P. configurations stable according to ideal MHD, characterized by axial currents up to 100 kA and rise times of about 1 μs. The experimental results obtained in a number of working conditions are discussed and compared. A preliminary account of the latest experiments is given. They include some results on the decay phase and the measurement of T_e by Thomson scattering. (auth)

14575 DESIGN OF A MINIMUM-SIZE TOROIDAL DT EXPERIMENTAL REACTOR (FINTOR). Bertolini, E. (CNEN-EURATOM, Frascati, Italy); Brunelli, B.; Engelmann, F. pp 485-495 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

A conceptual design study of an experimental tokamak reactor (FINTOR) aiming at the identification of the main physics and engineering limits to the minimum size of such a device is described. With the assumption that (a) the plasma density is limited by the usual equilibrium and stability constraints, (b) a plasma confinement not worse than one order of magnitude below the neoclassical limit can be achieved, and (c) only conventional technologies are to be adopted, a power in the range of a hundred MW and a wall loading of about 0.1 MW/m^2 results for the minimum-size reactor, but its geometrical dimensions are not much below those of a commerical reactor. To facilitate repair and replacements, a modular structure has been developed for the blanket and it is proposed to contain the reactor in a large vacuum vessel. (auth)

14576 MAJOR DESIGN FEATURES OF THE CONCEPTUAL D–T TOKAMAK POWER REACTOR, UWMAK-II. Conn, R. W.; Kulcinski, G. L.; Abdou, M. A. (Univ. of Wisconsin, Madison). pp 497-509 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381(Vol. 3); CONF-741105-P3.

The conceptual design of a 5000 MW(th) (approximately 1700 MW(e)) helium-cooled tokamak fusion reactor is presented. The fuel is deuterium and tritium and the structural material is 316 stainless steel. The design has a low aspect ratio (2.6) and low toroidal field on axis (35.7 kG) with 24 extended "D"-shaped superconducting TF coils. A superconducting air core transformer is designed with windings outside TF coils while the vertical field magnets, also superconducting, are inside the extended "D's". The plasma operating conditions have been determined using pessimistic scaling laws resulting from the trapped-ion instability. Such scaling can be beneficial in the reactor regime. A double-null poloidal field divertor is included for impurity control and a two-dimensional woven carbon cloth mounted on the vacuum chamber wall is included to protect the plasma from high-Z impurities and the first structural wall from erosion by charged-particle bombardment. The helium-cooled blanket contains solid Be in canned rods for neutron multiplication and solid lithium aluminate, also in canned rods, for tritium breeding. The breeding ratio is 1.19, the energy per fusion is 21.56 MeV, and the tritium inventory in the blanket is low, 42 g. Radiation damage problems are similar and as serious as those found in our previous study. Periodic replacement of blanket modules every two years will probably be required because of radiation damage. A detailed mechanism for blanket removal that does not require removal of the shield or the VF and TF coils is presented. (auth)

14577 PRINCETON REFERENCE DESIGN FUSION POWER PLANT. Price, W. G. Jr. (Princeton Univ., NJ). pp 525-533 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381(Vol. 3); CONF-741105-P3.

The Princeton Reference Design Fusion Power Plant is an electrical generating station based upon a large tokamak confining a D-T plasma. The plasma major and minor radii are nominally 10.5 m by 3.2 m; the toroidal field at the center-line is 6 T. With a mean ion temperature of 30 keV, an average beta of 0.04, and an average tau of 3.83 s a fusion power of 3440 MW is achieved during 97 minutes of the 100 minute long-pulse cycle. The plasma throughput of 2.8×10^{22} ions/s is deflected down a divertor channel where it cools by radiation and is neutralized, exhausting as hot gas to the vacuum pumps. The total thermal power of 5305 MW is carried by a helium coolant to a conventional steam cycle producing 2030 MW(e) net. Tritium is bred in an 80-cm thick blanket of eutectic flibe (53.1 percent beryllium fluoride and 46.9 percent lithium fluoride) with Nimonic PE-16 (43 percent nickel, 39 percent iron, 18 percent chromium) as the structural material; the blanket-averaged volume fractions are 69.8 percent flibe, 9.4 percent PE-16, and 20.8 percent helium. The breeding ratio of 1.4 will allow doubling of the 2.57 kg inventory in 121 days. The nominal wall load of 1.76 MW of DT neutrons per m^2 implies a total flux of 8.65×10^{18} n · m^{-2} · s^{-1} at the wall and a corresponding helium production rate of 275 ppM/year. (auth)

14578 DESIGN STUDY OF A TOKAMAK REACTOR. Sako, K.; Yamato, H.; Ohta, M. (Japan Atomic Energy Research Inst., Ibaraki). pp 535-548 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

A design study of a helium-cooled 2000-MW(t) tokamak reactor is carried out in order to clarify problems arising in the development of a fusion reactor. The following studies are performed: (1) Core plasma: various core-plasma parameters are determined on the assumption of quasi-steady operation of a tokamak reactor with an operation period of 6000 s. The main problems discussed are power balance, fuel supply, impurities, ignition and shutdown processes, and arrangements of vertical and transformer coils. (2) Reactor structure: most of the basic components affecting structural design are considered. Repair and maintenance schemes are also taken into account. (3) Neutronics: the nuclear heating rate and the tritium breeding ratio in the blanket are calculated. Radiation damage and magnet shielding are also evaluated. (4) Toroidal magnet: the structure design of the magnets is carried out. Magnetic field, ripples, electromagnetic forces, irregular arrangement, etc. are evaluated. (5) Neutral-beam injector: a neutral-beam injection system, which includes positive ion sources, subsequent gas cells cna energy recovery devices, is designed. (6) Electric-power supply system: the power supply systems for current transformer, vertical-field coils and neutral-beam injectors are analyzed. (7) Tritium recovery system: a concept of the recovery system for tritium from reactor coolant and plasma exhaust gas is considered. (8) Reactor cooling system: temperature-stabilizing methods for the blanket vessel and the coolant are reviewed. (auth)

14579 TWO-ENERGY-COMPONENT TOROIDAL FUSION DEVICES. Berk, H. L.; Furth, H. P.; Jassby, D. L. (Univ. of California, Livermore). pp 569-580 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381(Vol. 3); CONF-741105-P3.

Injection of a superthermal ion component into a toroidal plasma can raise the fusion power density to levels considerably higher than those attainable in ordinary one-component plasmas. As a result, energy break-even in D-T can be attained in bulk plasmas with n tau-values as low as 10^{13} cm^{-3}.s, at temperatures of approximately 5 keV. The optimal energy of the superthermal ion component is in the range 100 to 200 keV; injection-energy requirements can be reduced by adiabatic compression prior to or during the reaction phase. The appropriate ratio anti GAMMA of fast-ion pressure to bulk-plasma pressure is about 0.5. The stability of two-component tokamak plasmas was examined, and was found to be favorable for parameters of practical interest. (auth)

14580 DIRECT CONVERSION OF PLASMA ENERGY TO ELECTRICITY FOR MIRROR FUSION REACTORS. Moir, R. W.; Barr, W. L.; Carlson, G. A. (Univ. of California, Livermore). pp 583-592 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381(Vol. 3); CONF-741105-P3.

Direct conversion of both plasma and ion beam energy to electricity for mirror fusion reactors is described. Selective leakage, magnetic expansion, electron separation, deceleration, and collection of ions are discussed. An experiment testing all processes except selective leakage gave an overall efficiency of 86.5 +- 1.5 percent for a 22-stage collector. Computer calculations of these same processes gave an efficiency of 88.6 +- 1.5 percent, considered excellent agreement. Experiments on a two-stage collector gave 65 percent efficiency compared to 69 percent calculated efficiency. One-, two-, and 22-stage converters were studied under reactor-like conditions with a large computer simulation code that accounts for space charge, secondary electrons, and finite, realistic electrode shapes. The converters' efficiencies are estimated to be 48 percent, 58 percent and 63 percent, respectively. The efficiencies under the assumed reactor conditions are lower than under controlled laboratory conditions (86.5 percent). The one-stage converter is more cost-effective than the two-stage converter, which, in turn, is more cost-effective than the 22-stage converter; although more collector stages give higher efficiency, the simpler converters can handle more power. Conversely, if higher efficiency were desired, the studies show that it can always be achieved—but at a price. Laboratory tests of mono-energetic beam direct conversion gave 96 percent efficiency for a 2-keV low power d.c. beam and 70 percent for a d.c. 20 keV, 1-kW beam. The same computer code mentioned above is being used to design practical direct converters that reduce power requirements of neutral-beam injectors in the 100 to 200-keV range. (auth)

14581 CONCEPTUAL DESIGN OF A MIRROR REACTOR FOR A FUSION ENGINEERING RESEARCH FACILITY (FERF).

Batzer, T. H.; Burleigh, R. C.; Carlson, G. A. (Univ. of California, Livermore). pp 593-604 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381(Vol. 3); CONF-741105-P3.

A conceptual design is presented for a small mirror fusion reactor for a Fusion Engineering Research Facility (FERF). The reactor produces 3.4 MW of fusion power and a useful neutron flux of about 10^{14} $n.cm^{-2}.s^{-1}$. Superconducting "yin-yang" coils are used, and the plasma is sustained by injection of energetic neutral D^0 and T^0. Conceptual layouts are given for the reactor, its major components, and supporting facilities. (auth)

14582 ENGINEERING DESIGN OF A FUSION TEST REACTOR (FTB) AND FUSION ENGINEERING RESEARCH FACILITY (FERF) BASED ON A TOROIDAL THETA PINCH. Abdou, M.; Burke, R. J.; Dauzvardis, P. V. (Argonne National Lab., IL). pp 605-616 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381(Vol. 3); CONF-741105-P3.

This paper describes two advanced toroidal theta-pinch devices which are being proposed for future construction. The Fusion Test Reactor (FTR) is being designed to produce thermonuclear energy (at 20 MeV/neutron) equal to the maximum plasma energy (Q equals 1) and to demonstrate alpha-particle heating. The Fusion Engineering and Research Facility (FERF) is being designed to test materials in a fusion environment where the average 14-MeV neutron flux from the plasma is greater than or equal to 5×10^{13} $n/cm^2.s$ over large surface areas. These devices employ the staged theta-pinch principle where the heating is accomplished by rapid (approximately 0.1 mu s) implosion and expansion followed by a slow compression of the plasma. The rapid implosion injects as much heat as possible at as large a plasma radius as possible so that the plasma remains stable even after further compression. The final compression to ignition requires the transfer of a large amount of magnetic energy which implies a long transfer time (approximately 1 ms) for realistic voltages in the driving circuit. Throughout the heating and burn cycle the plasma must remain in equilibrium and stable to the dominant MHD-modes. A sufficiently large plasma radius guarantees stability against the m equals 1 modes. These equilibrium and stability conditions and the requirements on thermonuclear burn determine the design parameters for either machine. The design parameters must also be consistent with economic limitations and technological feasibility of components. In addition to these requirements, the FERF must provide a steady and reliable source of fusion neutrons. (auth)

14583 HELIOTRON AS A STEADY FUSION REACTOR. Iiyoshi, A.; Uo, K. (Univ., Kyoto). pp 619-630 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

This paper deals with a hypothetical steady fusion based on the heliotron. The magnetic-field configuration used is the $l = 2$ helical heliotron field with no toroidal coils. This model provides the simplest structure of heliotron reactor with a built-in divertor. By choosing the optimum geometry of the helical coil, a large rotational transform and a strong shear are obtained. For an estimated maximum β of $0.1 \sim 0.2$, diffusion remains near the plateau regime of neoclassical theory. Heliotron test reactor models for both physical and technological feasibility are discussed. It is expected that the heliotron reactor is more economical than the stellarator reactor. Characteristics of the heliotron divertor are discussed with regard to steady operation. (auth)

14584 PULSED REVERSED-FIELD PINCH REACTOR. Bodin, H. A. B.; Butt, E. P.; Carruthers, R.; James, T. E.; Newton, A. A.; Rostagni, G. (EURATOM, Abingdon, Eng.). pp 631-640 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381 (Vol.3); CONF-741105-P3.

General properties of the Reversed-Field Pinch (RFP) are described and its basis as a reactor discussed. RFP is axisymmetric and is the only toroidal system which proved to be stable in experiment at high $\beta \sim 30$ to 40%; its aspect ratio is unrestricted. Point models of burning show that ignition in D-T can be obtained by Joule heating in a few seconds. Calculations of the ratio of magnetic to plasma energy, on which the cost and economic operation depend, show RFP having advantages over tokamak and theta-pinch systems. Simple factors are found to determine the efficiency and circulating power and requirements for the blanket; its thinness and field penetration are discussed. A pulsed RFP with 10–100 s cycle time and fields rising in $\gtrsim 1$ s is attractive as a possible reactor and worthy of further study. (auth)

14585 INTERESTING POSSIBILITIES OF FUSION–FISSION. Werner, R. W. (Univ. of California, Livermore); Lee, J. D.; Moir, R. W.; Carlson, G. A.; Peterson, M. A.; Wolkenhauer, W. C.; Leonard, B. R. Jr. pp 641-648 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381(Vol. 3); CONF-741105-P3.

The hybrid reactor, a fusion plasma source driving a subcritical fission assembly, is discussed. Hybrids combine neutron-rich but power-poor fusion, with power-rich but neutron-poor fission. Hybrids may be realizable before pure fusion since they substantially relax the plasma and engineering requirements. A fissile blanket could be designed with one or more of the following primary goals: energy amplification on a power reactor, production of fissile fuel, and/or an interim system in the development of pure fusion. Lawrence Livermore Laboratory and Pacific Northwest Laboratory have undertaken several hybrid studies including fast fission blankets, thermal blankets, and fusion systems with power production as the primary goal. Present blanket studies have concentrated largely on neutronic performance, and energy multiplication in the 7 to 40 range has been demonstrated. Beyond the ability of the blanket to energy-multiply, it is necessary that many other design requirements be satisfied, such as structural, heat transfer and economics. Accessibility of the blanket for servicing is very important. System components other than the blanket must also be considered. A complete design study to determine whether the hybrid can be economically competitive and environmentally acceptable in a time period that precedes pure fusion has been begun by the authors. (auth)

14586 PROGRESS TOWARD THE DEVELOPMENT OF A MIRROR HYBRID (FUSION–FISSION) REACTOR. Leonard, B. R. Jr.; Wolkenhauer, W. C. (Pacific Northwest Labs., Richland, WA). pp 649-655 of Plasma Physics and Controlled Nuclear Fusion Research, 1974. Vol. III. Vienna; International Atomic Energy Agency (1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974). See STI/PUB-381(Vol. 3); CONF-741105-P3.

Pacific Northwest Laboratories (PNL), in cooperation with Lawrence Livermore Laboratory, has been studying a hybrid (fission-fusion) reactor based on a mirror magnetic confinement device. The fissile-blanket concept, based on a depleted uranium convertor and a slightly enriched uranium High Temperature Gas Cooled Reactor technology, has been developed at PNL. Using the DT plasma constraints and systems analysis primarily performed at LLL, the authors previously had reported the results of initial-condition neutronics calculations. These results projected a viable electrical power plant with 2000 MW(th) developed in the blanket, 680 MW(e) net, and probable breeding of both thermally fissile material and tritium in a subcritical fission blanket. In this paper, the authors report on the results of neutronics calculations performed through a 200-day operating period. These results confirm the performance characteristics originally proposed and, in fact, predict a larger average blanket energy multiplication and more positive fissile and tritium breeding over the operating period. The calculations also demonstrate the necessity of performing calculations during burn-up, at operating temperature, to obtain reliable performance parameters. In addition the paper reports on a minor design change, on the sensitivity of the calculated performance to ^{238}U data deficiencies, and a preliminary assessment of the importance of the broad source neutron energy spectrum of the mirror in the neutronics analysis. (auth)

Wave Phenomena

Refer also to abstract 14485.

14587 (CONF-750356-) SECOND INTERNATIONAL CONGRESS ON WAVES AND INSTABILITIES IN PLASMAS, INNSBRUCK, AUSTRIA, MARCH 17–21, 1975. Survey Lectures. Auer, G.; Cap, F. (eds.). (Innsbruck Univ. (Austria). Inst. fuer Theoretische Physik). 1975. 288p. Innsbruck Univ., Austria.

Separate abstracts were prepared for all 15 papers for inclusion in NSA. One of the 15 papers was abstracted and indexed in ERA. (WHK)

For abstracts of individual papers see: 14369, 14370, 14410, 14426–14428, 14485–14490, and 14588–14590.

14588 (CONF-750356, pp I1-I23) NONLINEAR WAVE MODULATION AND PLASMA CAVITIES. Ikezi, H. (Bell Labs., Murray Hill, NJ). 1975.

From 2nd international congress on waves and instabilities in plasmas (SICWIP); Innsbruck, Austria (17 Mar 1975).

In second international congress on waves and instabilities in plasmas. Survey lectures.

The interaction of an intense high-frequency field with a plasma causes numerous interesting nonlinear effects. Recent experimental, theoretical, and numerical studies have pointed out that the ponderomotive force, which modifies the plasma density distribution, causes the self-modulation of high-frequency field and the trapping of the electron plasma wave by forming a cavity in the plasma. This paper contains experimental observations of the modulational instability of the electron plasma wave which produces coupled-wave solitons and shocks. The behavior of the wave interactions in plasmas with various nonuniformity scalelengths and with an expanding plasma are described. A theory of coupled nonlinear electron-plasma and ion-acoustic waves is briefly summarized. (auth)

14589 (CONF-750356, pp P1-P64) COUPLING AND ABSORPTION OF LOWER-HYBRID WAVES IN A THERMONUCLEAR PLASMA. Puri, S.; Tutter, M. (Max-Planck-Institut fuer Plasmaphysik, Garching, Ger.). 1975.

From 2nd international congress on waves and instabilities in plasmas (SICWIP); Innsbruck, Austria (17 Mar 1975).

In second international congress on waves and instabilities in plasmas. Survey lectures.

The three important aspects, namely (i) accessibility, (ii) matching and (iii) absorption of the lower-hybrid waves in a thermonuclear plasma are studied under idealized but physically pertinent conditions within the framework of linearized theory. After two successive linear mode conversions–from an electromagnetic to a plasma wave and from the plasma to an electrostatic wave, respectively–the energy of the wave is deposited into the plasma ions in the presence of magnetic field gradients. It is shown that linear wave conversion is a very general phenomenon occuring at every confluence of real and complex waves in a lossless inhomogeneous medium. Computed values of the plasma surface impedance for a wide range of the longitudinal refractive index are presented to facilitate the design of both slow-wave and grazing-incidence coupling schemes for several existing or projected machines (WEGA, ATC, W VII, ASDEX, FT, PLT and the PPPL REACTOR). It is proposed that the difficult problem of frequency tracking necessary to heat the flat-topped thermonuclear plasmas near their core might be circumvented by the deliberate choice of a frequency well below the maximum lower-hybrid frequency in the plasma. In this scheme the rf energy introduced at the top (or bottom) access of the torus is carried to the plasma middle after both the wave conversions have already taken place near the edge of the plasma. It appears that the Buchsbaum's two-ion hybrid resonance might be the ideal method of heating themonuclear reactor plasmas. (auth)

14590 (CONF-750356, pp R1-R24) NONLINEAR EVOLUTION OF LOCALIZED LANGMUIR PERTURBATIONS. Ryutov, D. D. (Inst. of Nuclear Physics, Novosibirsk, USSR). 1975.

From 2nd international congress on waves and instabilities in plasmas (SICWIP); Innsbruck, Austria (17 Mar 1975).

In second international congress on waves and instabilities in plasmas. Survey lectures.

Nonlinear effects arising from phase mixing of resonant electrons interacting with Langmuir wave packets of finite length are considered. Some auxiliary problems of the interaction of resonant particles with strictly monochromatic waves (i.e., "infinitely long" packets) are discussed, and some properties of Langmuir packets are considered. On the basis of previous results, the problem of damping of a packet with a fixed phase velocity is solved, and some possible generalizations are pointed out. (WHK)

14591 (INIS-mf-1855, pp 15-24) ION BEAM PLASMA INTERACTION. 16 Apr 1975.

43 refs.

In ion beam plasma interaction. The production of a quiescent plasma.

The differences between ion beam and electron beam plasma systems are discussed. Considering beams of equal density and velocity, it is found that the ion beam plasma system is more stable with respect to the growth of electrostatic waves. When the wave has grown to a sufficiently large amplitude to trap the beam, the energy loss of the beam is larger in the case of an ion beam. In the second part of the chapter are some experimental configurations which might only be realized with serious difficulty when using electron beams. They are specially suited to be carried out with low velocity ion beams. In this context, the relevant work on ion beam plasma interaction is listed. (auth)

14592 (INIS-mf-1855, pp 25-54) EXCITATION OF ION CYCLOTRON HARMONIC WAVES BY INJECTION OF A 10 keV ION BEAM INTO A PLASMA. 16 Apr 1975.

This is modified version of the contribution of A. Goede, P. Massmann, H. J. Hopman, J. Kistemaker, G. J. Brakenhoff, submitted to the 5th IAEA Conf. on Plasma Physics and Controlled Nuclear Fusion Research, Tokyo, Japan, 1974; 33 refs., 13 figs., 2 tables.

In ion beam plasma interaction. The production of a quiescent plasma.

Presented in this paper are measurements concerning beam-plasma interaction occurring when an energetic ion beam is injected into a plasma. Also discussed is the relevance of these results to a Tokamak neutral beam injection scheme. The excitation of ion cyclotron harmonic waves, propagating azimuthally across the applied magnetic field have been observed. The excitation is attributed to the small perpendicular velocity component of the ion beam, independent of the parallel velocity. The experimental results are compared with the linear theory of electrostatic instabilities in a Maxwellian plasma traversed by a monoenergetic beam with dc energy components parallel and perpendicular to the magnetic field. (auth)

14593 (INIS-mf-1856) NONLINEAR EFFECTS IN AN ELECTRON BEAM–PLASMA SYSTEM. van Wakeren, J. H. A. (Amsterdam Univ. (Netherlands)). 16 Apr 1975. 92p. INIS.

Thesis.

The interaction of a 1-2KeV electron beam and a plasma in an axial homogeneous magnetic field is studied by means of an electrostatic energy analyzer. Near the electron gun a wave starts at a small amplitude and grows in space until the beam is trapped in the wave electric field at some fixed distance from the gun and saturation of the wave occurs. The time averaged measured velocity distribution changes into a plateau type distribution symmetric around the phase velocity of the wave. At greater distance when the wave has decayed away, a new wave grows until the beam is trapped again; this results in the formation of a new and broader plateau in the distribution function, this plateau is symmetric around the phase velocity of this wave. In this way, successive energy transfer occurs by successive beam trapping each time resulting in a further broadening of the beam velocity distribution function. Further correlation measurements show that the second harmonic cyclotron instability follows the plasma instability. Also the behavior of the amplitude and the phase of the plasma instability as function of time and space has been investigated. From these measurements it becomes clear which electric fields a beam electron meets when it is passing through the plasma column. The phase velocities of the waves differ from the initial beam velocity, so every electron enters the wave at an arbitrary phase of the wave. The beam electrons have to pass several instability regions without mutual phase correlation, which is in favor of the thermalization of the beam. Finally, the attractiveness of using intense relativistic electron beams for ignition of a nuclear fusion reactor is shown. (auth)

14594 HYDRODYNAMIC EXCITATION OF LOW-FREQUENCY SURFACE WAVES IN A LIMITED NON-ISOTHERMAL PLASMA BY MEANS OF AN ELECTRON OR ION BEAM. Zeljazkov, I.; Nenovski, P. God. Sofii. Univ., Fiz. Fak.; 65: 105-116(1973). (In Russian).

A theoretical investigation is made of the excitation of low-frequency surface waves in limited flat parallel plasma with the aid of electron and ion beams. Two cases are considered: (a) when the cold beam passes through the plasma layer limited by vacuum; and (b) when the cold beam passes through a vacuum layer limited by non-isothermal plasma. The growth differential of the oscillations is established and it is shown that the created instability is convectional. It is indicated that in order to excite plasma waves hydrodynamically by means of a beam of loaded particles, the beam should be homogeneous as regards power. (Abstr. Bulg.)

14595 ENHANCEMENT OF THE INTERACTION BETWEEN TRANSVERSE AND LONGITUDINAL WAVES BY TURBULENT PLASMON CONDENSATION. Kamilov, K. (Tadzhik State Univ., USSR); Khakimov, F. K.; Stenflo, L.; Tsytovovich, V. N. Phys. Scr.; 10: No. 4, 191-193(Oct 1974).

It is shown that three-wave interaction processes can be enhanced and change sign in the presence of strong Langmuir turbulence, which is treated as a nonlinear stage of modulational

instability of plasmon condensation. In particular the possibility of enhanced emissions at the double plasma frequency ($\omega_t \sim 2\omega_p$) is pointed out. It is demonstrated that depression occurs when the intensity of the transverse wave is less than a certain threshold value but that the wave is enhanced when it is larger than this value. (auth)

14596 QUASI-LINEAR SPECTRUM OF CURRENT DRIVEN ION CYCLOTRON WAVES. Harvey, R.W. (University of California at San Diego, La Jolla, California 92037). Phys. Fluids 18: No. 12, 1790-1799 (Dec 1975).

Quasi-linear theory is applied to the current-driven, longitudinal ion cyclotron instability in a magnetized, collisional electron-proton plasma. A quasi-stationary state, consisting of a balance between current excitation of the spectrum and collisional effects, is obtained when the applied electric field is marginally greater than instability threshold. This state ceases to exist when quasi-linear diffusion of the protons exceeds velocity space collisional diffusion. Solution of the ion kinetic equation is by an iterative technique utilizing variational properties of the collision operator. Results are considered within the context of the solar wind plasma. (auth)

14597 HARMONIC GENERATION BY GOULD–TRIVELPIECE MODES PROPAGATING INTO AN AXIAL DENSITY GRADIENT. Hirshfield, J.L.; Bernstein, I.B. (Department of Engineering and Applied Science, Yale University, New Haven, Connecticut). Phys. Fluids 18: No. 12, 1787-1789 (Dec 1975).

Prior experiments on the propagation of electrostatic waves on a plasma column (Gould–Trivelpiece modes) have shown linear wave reflections from an adjustable axial density gradient which scaled according to the predictions of WKB theory. For finite amplitude incident waves at radian frequency $\omega < \omega_{po}$, we have observed strong harmonic production at frequencies $n\omega < \omega_{po}$ where n in an integer and ω_{po} is the mean electron plasma frequency in the axially uniform part of the column. The harmonic production appeared to originate in the axially nonuniform plasma, and decreased markedly as the gradient was reduced experimentally. No threshold for harmonic production was observed, thus suggesting that parametric effects were not important. Second-order perturbation theory based on the cold plasma equations is applied to an axially nonuniform plasma in a strong uniform axial magnetic field. The results show that nonlinear source terms enter into the governing differential equation for the second-harmonic potential which are larger than the customary nonlinear terms for an axially uniform column, by a factor as large as $(\omega_p R/\omega L)^4$ where R is the plasma radius and L is the scale length of the inhomogeneity. Enhancement in harmonic production predicted by this model is in quantitative agreement with the experiment. (auth)

14598 PROPAGATION OF ION-ACOUSTIC WAVES IN A TWO-ELECTRON-TEMPERATURE PLASMA. Jones, W.D.; Lee, A.; Gleman, S.M.; Doucet, H.J. (Department of Physics, University of South Florida, Tampa, Florida 33620). Phys. Rev. Lett. 35: No. 20, 1349-1352 (17 Nov 1975).

The propagation of ion-acoustic waves (IAW) in a double-electron-temperature plasma is investigated both experimentally and theoretically. It is found that the presence of even a small fraction of the lower-electron-temperature component can dominate the behavior of the waves. The results have important implications both for the use of IAW as a diagnostic tool for measuring electron temperature and for the interpretation of turbulent IAW spectra. (auth)

14599 CYLINDRICAL ION WAVE EXCITED BY A MODULATED THIN ELECTRON BEAM. Ohnuma, T.; Fujita, T.; Shibata, K.; Adachi, S. (Department of Electrical Engineering, Tohoku University, Sendai, Japan). Phys. Fluids 18: No. 12, 1818-1820 (Dec 1975).

When a circular thin electron beam modulated at a prescribed frequency is injected into a weakly magnetized plasma along the magnetic field, cylindrical ion waves are found to be launched in the direction nearly perpendicular to the electron beam both experimentally and theoretically. (auth)

14600 PHASE LOCKING THE AUTO-RESONANT ACCELERATOR. Lohr, J. (Fusion Research Center, University of Texas at Austin, Austin, Texas 78712). Phys. Fluids 18: No. 12, 1822-1823 (Dec 1975).

The normal development of the beam-plasma instability to a broadened fluctuation spectrum can be retarded by the injection of a plasma wave at the most unstable frequency. (auth)

14601 PROPAGATION AND COLLISIONLESS ABSORPTION OF LINEARLY CONVERTED LOWER HYBRID PLASMA WAVES. Simonutti, M.D. (California Institute of Technology, Pasadena, California 91125). Phys. Fluids 18: No. 11, 1524-1532 (Nov 1975).

Mode conversion and collisionless absorption of externally driven waves in the lower hybrid frequency range in an inhomogeneous plasma are described through numerical analysis of the locally evaluated linear dispersion relation for a homogeneous plasma. The effects of finite temperature and inhomogeneity of the plasma are emphasized since, according to the linear theory, these effects are responsible for the eventual absorption of the waves by the plasma. The exact forms of the dispersion relations, derived first from the two-fluid equations with an isotropic pressure law and then from the Vlasov equation, are analyzed for plasma parameters applicable to present day tokamaks. The two-fluid theory predicts that a mode conversion to an acoustic wave takes place near the lower hybrid resonance density layer. The Vlasov theory, in addition, predicts that this may be followed by a second mode conversion at a lower density. The results of the Vlasov theory also include electron Landau damping and ion cyclotron harmonic damping. (auth)

14602 EFFECT OF PHASE-CORRELATED ELECTRONS ON WHISTLER WAVEPACKET PROPAGATION. Denavit, J. (Department of Mechanical Engineering and Astronautical Sciences, Northwestern University, Evanston, Illinois 60201); Sudan, R.N. Phys. Fluids 18: No. 11, 1533-1541 (Nov 1975).

The evolution of large-amplitude whistler wavepackets in a hot collisionless plasma is examined. When resonant electrons are trapped in the wave during a transit time, they acquire a correlation in phase of their perpendicular velocities relative to the local wave magnetic field, which causes new emissions and elongates the wavepacket in the direction of emergence of the resonant electrons. This is explained in terms of equations of propagation for the wavepacket amplitude, wavenumber, and frequency, involving phase correlated particles. The results of computer simulations showing the elongation of large-amplitude wavepackets, and the wavenumber and frequency characteristics of the new emission are presented. (auth)

14603 SCATTERING OF ELECTROMAGNETIC WAVES INTO PLASMA OSCILLATIONS VIA PLASMA PARTICLES. Lin, A.T.; Dawson, J.M. (Department of Physics, University of California, Los Angeles, California 90024). Phys. Fluids 18: No. 11, 1542-1545 (Nov 1975).

A plasma subjected to an intense electromagnetic wave can exhibit a large number of parametric instabilities. An interesting example which has received little attention is the decay of the electromagnetic wave into a plasma oscillation with the excess energy and momentum being carried off by electrons. This process has been simulated on a one–and–two–halves dimensional electromagnetic code. The incident electromagnetic wave had a frequency near the plasma frequency so that decay into a plasma oscillation and a backscattered electromagnetic wave was excluded. As expected, the threshold for this instability was very large, so it is unlikely that this instability is competitive in most laser plasmas. Nevertheless, the physical mechanism involved provides a means for absorption of laser light and acceleration of particles in a plasma containing large amplitude plasma oscillations. (auth)

14604 DERIVATION OF CONNECTION FORMULAS FOR WAVE CONVERSION IN INHOMOGENEOUS PLASMA. Peratt, A.L. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). Phys. Fluids 18: No. 11, 1586-1587 (Nov 1975).

Connection formulas relevant to the description of wave conversion in inhomogeneous plasma have been derived. (auth)

14605 CONSTANT LONGITUDINAL ELECTRIC FIELD INDUCED BY CIRCULARLY POLARIZED PLANE WAVES IN A COLLISIONAL COLD PLASMA. Lai, H.; Chan, Y. (Department of Physics, Chung Chi College, The Chinese University of Hong Kong, Shatin, Hong Kong). Phys. Rev. Lett. 35: No. 18, 1226-1228 (3 Nov 1975).

A self-consistent constant longitudinal electric field is shown to exist in a collisional electronic cold plasma through which a circularly polarized plane wave is propagating. This electric field arises from the displacement of the electrons from the immobile ions and constitutes a return force which exactly balances the forward Lorentz force due to the collisions. (auth)

14606 ANOMALOUS ELECTRON TRANSPORT AND LOWER-HYBRID WAVE DAMPING. Chu, C.; Dawson, J.M. (Physics Department, University of California, Los Angeles, California 90024); Okuda, H. Phys. Fluids 18: No. 12, 1762-1768 (Dec 1975).

The transport of electrons across magnetic fields was investigated by two-dimensional computer experiments. Under the modest condition $\omega_{ce} \simeq \omega_{pe}$ which occurs in many laboratory plasmas and fusion devices, it is found that the electron heat and momentum transport rates are much enhanced above the classical collisional values even for plasma very close thermal equilibrium. The enhancement is due to electron turbulent motion in the fields of thermally excited lower hybrid waves. Nonthermal plasmas could show an even larger degree of enhanced transport. Employing a fluid model which includes turbulent viscous terms in the electron momentum equation, linearized theory gives predictions which are in reasonably good agreement with the observed wave damping. The computer results throw some light on the theory of strong turbulence, comparison with such theories points up some

discrepancies and indicates the proper method for including the turbulence effects. Estimates of the electron heat transport in three-dimensional thermonuclear plasmas due to this mechanism gives values comparable to those predicted by neoclassical theory from thermal fluctuations alone; enhancement of the fluctuations above the thermal level will given higher transport rates. These results suggest that nonclassical effects can be very important in plasma transport and could be important for fusion plasmas. (auth)

ENGINEERING

14607 (CONF-750867-) SYSTEMS ENGINEERING FOR POWER: STATUS AND PROSPECTS, HENNIKER, NEW HAMPSHIRE, AUGUST 17–22, 1975. Fink, L. H.; Carlsen, K. (eds.). (Energy Research and Development Administration, Washington, D.C. (USA)). 1975. 487p. Dep. NTIS $10.60.

Twenty-two papers were presented at the conference. A separate abstract was prepared for each paper for ERA. In addition, one paper was also abstracted for NSA. (RCK)

For an abstract of an individual paper see: 16549.

Energy Conversion

Refer also to abstracts 14996, 14997, and 15704.

14608 HYDROGEN–OXYGEN CLOSED CYCLE MHD POWER GENERATION SYSTEM BASED UPON THERMOCHEMICAL DECOMPOSITION OF WATER. Nakamura, T. (Electrotechnical Lab., Tokyo); Riedmueller, W. Energy Convers.; 15: No. 1/2, 59–63(1975).

A new closed cycle energy conversion system in which an MHD generator operates on hydrogen and oxygen produced from water by means of multi-step thermochemical decomposition processes is proposed. It is shown that the MHD generator and the thermochemical decomposer can be combined effectively in the power generation process and that the conversion of nuclear heat available from already existing reactors into electricity can be done at efficiencies close to the Carnot efficiency. Overall thermal efficiencies higher than 50% can be achieved if the thermochemical decomposer operates at efficiencies higher than about 50%. The operating conditions for the thermochemical decomposer in the proposed system are favorable for it to attain such high decomposition efficiencies. (auth)

Facilities and Equipment

Refer also to abstract 15243.

14609 (BNL-20684) FORMULATION OF STIFFNESS EQUATION FOR A THREE-DIMENSIONAL ISOPARAMETRIC ELEMENT WITH ELASTIC-PLASTIC MATERIAL AND LARGE DEFORMATION. Chang, T. Y.; Prachuktam, S.; Reich, M. (Brookhaven National Lab., Upton, N. Y. (USA)). 3 Nov 1975. 17p. Dep. NTIS $4.50.

The formulation of the stiffness equation for an 8 to 21 node isoparametric element with elastic-plastic material and large deformation is presented. The formulation has been implemented in a nonlinear finite element program for the analysis of three-dimensional continuums. To demonstrate the utility of the formulation, a thick-walled cylinder was analyzed and the results are compared favorably with a known solution. The element type presented can be applied not only to 3-D continuums, but also to plate or shell structures, for which degenerated isoparametric elements may be used. (auth)

14610 (JINR-P13-9221) FIVE-LAYER FERROMAGNETIC SCREEN WITH THE VOLUME OF 1.5 m^3. I. Construction. Alekseev, N. A.; Voronov, B. I.; Konstantinov, V. I.; Taran, Yu. V. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

A five-layer cylindrical permalloy screen is described with the internal volume of about 1.5 m^3 intended for shielding from the geomagnetic field and from the low frequency noise of the "Tristom" installation used for measuring the electrical dipole moment of a neutron by ultracold neutrons. The residual magnetic field $(3/3,5) \times 10^{-5}$ Oe has been obtained in the center of the screen. The stability of the field was kept within $+- 0,5 \times 10^{-5}$ Oe during a month. The screen can be used for gauging of the magnetometric devices of different designation and for that purpose the screen has holes 150 mm in diameter at the ends. (auth)

14611 (SAND-75-0485(Rev.)) BIBLIOGRAPHY: SANDIA LABORATORIES HYBRID MICROCIRCUIT AND RELATED THIN FILM TECHNOLOGY (REVISED). Oswalt, J. A. (comp.). (Sandia Labs., Albuquerque, N. Mex. (USA)). Dec 1975. Contract AT(29-1)-789. 61p. Dep. NTIS $4.50.

Sandia originated documents (94) describing aspects of technology development related to hybrid microcircuits and thin films are summarized. Authors, titles, and abstracts are given for each unclassified document. The papers are categorized according to the various technologies involved in hybrid microcircuit production. (auth)

14612 HEAT EXCHANGER ANALYSIS IN THE CASE OF INCOMPLETE INFORMATION. Chaban, O. Y.; Telyuk, B. A.; Shkrabti, R. V.; Danilov, A. I. (Polytechnical Inst., Lvov). Heat Transfer–Sov. Res.; 7: No. 3, 89-92(1975).

Translated from IVUZ, Energetika; 11: 133-136(1974).

To determine the relationship between the changes in variables in convective and radiative heat exchangers, one needs to know only the initial temperature. The absolute values of variables not directly related to temperature need not be known. (auth)

14613 ARRANGEMENT FOR SELECTIVELY IRRADIATING WEBS. Ihme, B. (to Veb Textikombinat Cottbus). US Patent 3,911,281. 7 Oct 1975. Filed date 12 Feb 1974. 6p.

The arrangement for selectively irradiating a web includes a perforated band of a radiation impermeable substance which is guided in an endless path via a pair of guide rollers and has two juxtaposed runs in this path. A take-up roller conveys a web of material past one of the runs at a side thereof remote from the other run, the direction of movement of the web being other than parallel to that of the band and, preferably, normal thereto. An electron accelerator is provided at the far side of the run remote from the web and is effective for directing a radiation beam at the web through the perforations. (auth)

14614 IRRADIATING ELONGATED MATERIAL. Swartz, R. K. (to Western Electric Co., Inc.). US Patent 3,916,204. 28 Oct 1975. Filed date 3 May 1974. 18p.

A plurality of conductors covered with crosslinkable insulation are advanced past an accelerator window with the stringup of each being accomplished to present a number of passes of each conductor to the accelerator beam and to cause uniform dosing of the insulation. A shutter associated with each conductor and spanning all the passes thereof is mounted for movement between the associated conductor and the accelerator to shield the conductor from the beam. When the supply of one of the conductors is about to be exhausted and requires a splice to a new supply, the line speed of that conductor is decelerated while the associated shutter is interposed between that conductor and the beam in synchronization with the line speed relative to dosimetry data to provide a constant dose exposure per pass during the splicing. The movement of the shutter is similarly coordinated with the acceleration of the conductor to line speed following the splicing operation. (auth)

14615 PULSE DISCRIMINATOR CIRCUIT FOR PARTICLE INVESTIGATION. Hogg, W. R. (to Coulter Electronics Ltd., Harpenden (UK)). German (FRG) Patent 2,448,303/A/. 17 Apr 1975. 15p. (In German)

The design is given of a pulse amplitude discriminator circuit used in measuring the medium volume of blood platelets and red blood corpuscles. The particles flow in a fluid through a coverage zone, where each produces a particle pulse whose amplitude is assigned to the particle size. An electrical circuit with two computer recording comparators determines the pulses whose amplitude lies between a given upper and lower amplitude cone, stores every pulse during the determination, and passes only the pulse heights equal to a stored pulse. A circuit consisting of a back edge detector, a univibrator, and a flipflop controls the electrical circuit. (DE)

14616 INTEGRIERTE DIGITALSCHALTUNGEN. Angaben in Datenblaettern, Binaere Folgeschaltungen. Entwurf. (Integrated Digital Circuits. Recommendation for Data Sheets for Binary Sequential Circuits. Draft). Berlin, F. R. Germany; Beuth (Jun 1972). 4p. (In German). (DIN–41797(B1.2)).

3 figs.

A draft standard is presented giving recommendations for the casing data, circuit description, limiting values, and electrical characteristics of integrated digital circuits. (DE)

Lasers

Refer also to abstracts 14993 and 16104.

14617 (AD-709708) CONSTRUCTION AND SIMULATION OF A GAS-DYNAMIC LASER. Reedy, R. E. (Naval Postgraduate School, Monterey, Calif. (USA)). Jun 1970. 55p. NTIS $3.00.

Thesis.

The thesis discusses the theory behind the gas dynamic laser. A computer program that solves the equations is included along

with typical outputs. A description of a test apparatus is also presented with proof of laser action. (auth)

14618 (AD-711141) INVERSE POPULATING OF ARGON LEVELS IN A SUPERSONIC PLASMA JET. Goldfarb, V. M.; Ilina, E. V.; Kostygova, I. F.; Luykanov, G. A. Translated by M. Claechea from Uch. Zap., Leningr. Gos. Pedagog. Inst. im. A. I. Gertsena; 384: No. 2, 122-128(1968). 11p. (FTD-HT-23-237-10). NTIS $3.00.

The supersonic Ar plasma jet was cooled by rapid expansion into vacuum. The population inversion of Ar levels and negative absorption coefficient were found spectrographically. This reveals the possibility of making a gas-dynamic laser. (auth)

14619 (AD-713275) OPTICALLY PUMPED GAS-DYNAMIC MOLECULAR LASER. Batanov, V. A.; Bunkin, F. V.; Prokhorov, A. M.; Fedorov, V. B. Translated from Dokl. Akad. Nauk SSSR; 191: No. 6, 1267-1269(1970). 5p. (NIC-Trans-3127). NTIS $3.00.

The advantages of molecular gases in lasers with noncoherent optical pumping are well known and conditioned on the one hand by a relatively broad spectral pumping-light absorption band, and on the other by a relatively narrow working-transition line width. One such laser—the photodissociation laser—has been in existence for a long time. The present paper proposes an infrared molecular laser with optical pumping to the vibrational-rotational band of the molecule in the electron ground state, and noncoherent emission from an "immovable" shock wave arising during steady escape of the working mixture from the nozzle under conditions of incomplete expansion of the gas into the atmosphere. The composition of this gas can either correspond or not with that of the working mixture. For simplicity, by working mixture the authors mean the mixture $CO_2 + N_2 + He$. In this, helium plays the same role as in CO_2 lasers with electrical discharge. The nitrogen mixture is not necessary to achieve inversion, but it proves favorable, laser level and, secondly, to expansion of the vibrational-rotational pumping absorption band. (NTIS)

14620 (AD-713497) GAIN MEASUREMENTS IN A RAPID GAS-DYNAMIC EXPANSION. Hoffman, A. L.; Mullaney, G. J.; Holden, M. T.; Pindroh, A. L. (Boeing Scientific Research Labs., Seattle, Wash. (USA)). Oct 1970. 22p. (D-1-82-1006). NTIS $3.00.

A double expansion nozzle was used in a shock tube facility to study the population inversions achieved in a CO_2 lasing gas mixture. For these experiments the double expansion nozzle, a form of gas-dynamic throttle, was a means for increasing the gain path length in the shock tube apparatus by a factor of five. Gain measurements were made for various reservoir conditions of temperature (1000 or = T(0) or = 2600°K) and pressures after final expansion through a Mach = 4, twenty-nine element, multiple nozzle to (5 or = p or = 100 torr). The small signal gain is a function of the population inversion in the non-equilibrium flow and the line broadening. Measurements were made in both the collision and Doppler broadened regions. Numerical computations were made based on available relaxation rates and compared with experiment. Evaluations of the accuracy of these rates were made, and in the case of the depopulation of the lower laser state due to helium it was found that the V-T rate is faster than previously thought. Thus, gain measurements in a gas dynamic expansion can actually be used to measure relaxation rates. (auth)

14621 (AD-718131) RATE COEFFICIENTS FOR VIBRATIONAL ENERGY TRANSFER IN RAPID EXPANSIONS OF CARBON DIOXIDE-NITROGEN MIXTURES. MacDonald, J. R. (Stanford Univ., Calif. (USA). Inst. for Plasma Research). Dec 1970. Contract F44620-68-C-0051. 200p. (SU-IPR-394). NTIS $3.00.

An investigation of vibrational energy transfer processes in a rapid expansion containing N_2, CO_2, and Ar is presented along with related analyses. In the experiment, arc-heated Ar was mixed with N_2 and CO_2 and a rapid expansion was obtained by expanding the gas mixture in an underexpanded free jet. The stagnation temperature was varied from 1900 to 2900°K and the stagnation pressure was held near 2.7 atm. Particular emphasis was placed on ensuring gas purity and the test gas was analyzed to obtain quantitative measurements of gas purity. The vibrational temperatures of N_2 and CC_2 (V3) were determined from spatially-resolved spectroscopic measurements. In addition, information was obtained about the $CC_2(V3 + 3V2)$ intramolecular and the CO_2 V-T processes in the rapid expansion. The results show that the rate coefficients needed to match the theory to the data generally exceed those measured in shock-heating and laser-fluorescence experiments. The importance of these measurements with regard to prediction of CO_2-N_2 gasdynamic laser performance is also discussed. (auth)

14622 (AD-718805) NUMERICAL EXPERIMENTS ASSOCIATED WITH GAS-DYNAMIC LASERS. Anderson, J. D. Jr. (Naval Ordnance Lab., White Oak, Md. (USA)). 24 Sep 1970. 72p. (NOLTR-70-198). NTIS $3.00.

A previous time-dependent finite-difference numerical solution of second order accuracy for quasi-one-dimensional nonequilibrium nozzle flows using 3 terms of a Taylor's series expansion in time is modified such that only 2 terms of a series expansion are required for second order accuracy. As a result, an already straightforward analysis of nonequilibrium nozzle flows is made even simpler. With the present solution, numerical experiments are carried out for gas dynamic laser flows in order to study the consequences of large H_2O content, high reservoir pressures and small nozzle throat heights. (auth)

14623 (AD-720794) ANALYTICAL MODEL FOR A CONTINUOUS CHEMICAL LASER. Report for June 1969—June 1970. Emanuel, G. (Aerospace Corp., El Segundo, Calif. (USA)). 30 Sep 1970. Contract F04701-70-C-0059. 87p. NTIS $3.00.

A simplified theoretical analysis of a continuous chemical laser is presented, primarily to acquaint the reader with the constant-gain method of solution and to emphasize the strong coupling in the cavity between the radiation and the chemistry. Lasing is assumed to occur in a Fabry-Perot cavity on vibration-rotation transitions between two vibrational levels of a hypothetical diatomic molecule. A Boltzmann distribution is assumed for the rotational populations, thereby further restricting lasing to the maximum gain transition in the P-branch. New features in this study include: (1) an analysis of J-shifting in which lasing shifts from one rotational transition to the next; (2) a demonstration that the closed cavity condition, wherein the mirrors are perfectly reflecting, is an indeterminate limit with a finite output power; and (3) a comprehensive parametric analysis that indicates that a high lasing efficiency might be attainable under certain operating conditions. (auth)

14624 (AD-721735) GAIN KINETICS OF HIGH PRESSURE GAS-DYNAMIC LASERS. Christiansen, W. H.; Tsongas, G. A. (Washington Univ., Seattle (USA). Aerospace Research Lab.). Feb 1971. Contract N00014-67-A-0103-0008. 34p. NTIS $3.00.

A combined analytical and experimental investigation of rapidly expanded CO_2 laser mixtures is described. Study of the vibrational kinetics indicates that population inversions with high vibrational energy density can be produced at high pressures by utilizing low (starved) concentrations of CO_2. Scaling laws for predicting the gain of starved systems are developed. A description is given of gain measurements carried out using a CO_2 laser to probe the flow in a nozzle at the point where the Mach number is approximately four. Population inversions at static pressures as high as about one atmosphere have been observed and found to be in reasonable agreement with predictions. (auth)

14625 (AD-723961) THERMAL LASER EXCITATION BY SUPERSONIC MIXING IN A GAS-DYNAMIC NOZZLE. Pratt, H. L. (Army Missile Command, Redstone Arsenal, Ala. (USA)). 1 Apr 1971. 88p. (RR-TR-71-2). NTIS $3.00.

An arc-driven laser suitable for gas-dynamic and similar modes of operation is described. Inversion is obtained by rapid expansion of hot gas mixtures through a supersonic aerodynamic nozzle. Upper vibrational lasing levels are "frozen" at pre-expansion conditions while the lower levels are characterized by conditions in the supersonic flow downstream of the nozzle. A population inversion exists for some distance downstream. Inversion is enhanced by the injection of additives to relax the lower levels at a faster rate. The system is so designed that the gases used, the mixture ratios, and the mass flow rates, as well as the specific enthalpy of the system, may be varied nearly independently. In addition, gases may be injected at various points along the flow, and the results of this feature are stressed. The laser has been operated under marginal gas-dynamic conditions with all component gases of a CO_2 system premixed prior to expansion. However, most of the work presented deals with the injection of cold CO_2 into the hot supersonic flow mixture immediately downstream of the nozzle throat. The report illustrates how parametric studies may be made of various aerodynamic systems. In particular, the effects of controlled amounts of impurities, such as those formed in various combustion processes, may be investigated. (NTIS)

14626 (AD-727757) FLAME-SHEET ANALYSIS OF CW DIFFUSION-TYPE CHEMICAL LASERS. Report for April—December 1970. Hofland, R. Jr.; Mirels, H. (Aerospace Corp., El Segundo, Calif. (USA)). 15 Jul 1971. Contract F04701-71-C-0172. 89p. NTIS $3.00.

From 9th AIAA aerospace sciences meeting; New York, NY, USA (25 Jan 1971).

An analytical treatment of diffusion-type chemical lasers is presented. Chemical formation of the lasing molecule by laminar mixing and combustion of parallel streams of fuel and oxidizer is assumed to be diffusion controlled, and subsequent collisional deactivation of each vibrational level of the lasing molecule by nonreactive V-V and V-T energy transfer is found by a successive-approximation scheme. Radiative processes are considered only in zero-power and high-power limits. A laser employing the reaction $H_2 + F$ yields $HF(v) + H$ is considered in detail with the use of a single-boundary-layer, flame-sheet model. Expressions for integrated zero-power gain, laser power, and efficiency are obtained. (auth)

14627 (AD-731475) MIXING PHENOMENA RELATED TO CW CHEMICAL LASERS. Hayday, A. A. (SCICOM, Inc., Huntsville, Ala. (USA)). Jul 1971. Contract DAAH01-71-C-0218. 95p. NTIS $3.00.

The report concludes a brief preliminary study on mixing phenomena related to continuous wave chemical laser injector systems. It is largely a survey of existing information on mixing of high and low speed, turbulent, chemically active gases. Several different flows that may occur near the cavity entrance are identified and reliability of available mixing models is assessed. Two main configurations are treated: mixing of parallel streams and mixing in cross-flows. Factors affecting the rapidity of mixing are given. Topics on mixing of parallel flows include: (1) supersonic-subsonic interactions of isobaric jets of significantly different molecular weights; (2) influence of highly exothermic reactions and transverse pressure gradients; (3) effects of adverse pressure gradients and the possibility of wake flows with base bleeding; and (4) limitations of boundary layer mixing models. Interactions of perpendicularly oriented streams are discussed for both low speed flows and the case of a secondary jet issuing through a sonic orifice into a supersonic main stream. Methods for estimating penetration depth by the secondary jet are given and effectiveness of mixing in cross-flows is compared with the parallel flow configuration. (auth)

14628 (AD-732374) POPULATION INVERSIONS IN AN EXPANDING GAS: THEORY AND EXPERIMENT. Anderson, J. D. Jr.; Humphrey, R. L.; Vamos, J. S.; Plummer, M. J.; Jensen, R. E. (Naval Ordnance Lab., White Oak, Md. (USA)). 28 Jun 1971. 41p. (NOLTR-71-116). NTIS $3.00.

It is well established that population inversions between the (001) and (100) vibrational energy levels of CO_2 can be created by rapid expansions of $CO_2-N_2-H_2O$ or He mixtures through supersonic nozzles. New experimental results are presented for such inversions. These experiments were conducted in both the 3 MW arc tunnel and the 12.7 cm shock tunnel at the Naval Ordnance Laboratory. The results support previously published theoretical predictions obtained with a numerical, time-dependent, nonequilibrium nozzle flow analysis employing a simplified vibrational kinetic model. This theory is also compared with experimental data obtained by other investigators. (auth)

14629 (AD-735878) COMPUTER PROGRAM FOR $CO_2-N_2-H_2O$ GAS-DYNAMIC LASER GAIN AND MAXIMUM AVAILABLE POWER. Glowacki, W. J.; Anderson, J. D. Jr. (Naval Ordnance Lab., White Oak, Md. (USA)). 30 Oct 1971. 38p. (NOLTR-71-210). NTIS $3.00.

A Fortran IV computer program is described for the calculation of small-signal gain and maximum available energy for $CO_2-N_2-H_2O$ gasdynamic lasers. In comparison to an earlier version, the present program contains several computational improvements which result in a dramatic, order-of-magnitude reduction in computation time. These improvements are discussed in detail. (auth)

14630 (AD-737994) GAS-DYNAMIC LASER TECHNOLOGY STUDIES. Final Report, June 1968–15 July 1970. (Naval Ordnance Lab., White Oak, Md. (USA)). 15 Jul 1970. 75p. (NOLTR-70-139). NTIS $3.00.

A gas dynamic laser system was designed and put in operation by modifying the 3 MW arc tunnel. Independent analytical studies assisted in the design of the experiments. Comparison of analytical prediction and experiments, which were carried out under less than ideal conditions, give fair to very good agreement. Further experiments have been designed on the basis of the current investigations. (auth)

14631 (AD-741335) CONTINUOUS WAVE CHEMICAL LASER MODELING ASSUMING INSTANTANEOUS MIXING. Roberts, T. G.; Friday, W. A.; Howgate, D. W.; Barr, T. A. Jr. (Army Missile Command, Redstone Arsenal, Ala. (USA)). 31 Dec 1971. 48p. NTIS $3.00.

The results of a theoretical effort to develop models which will be useful in the experimental program to study certain chemical lasers are presented. A simple model of a flowing continuous wave chemical laser assuming instantaneous mixing is developed and used to treat the Cl + HBr reaction as an illustrative example. A nozzle exit and cavity program which was developed to treat gas dynamic lasers is to be used to modify the model studied for transfer chemical lasers. The results obtained using this program to make numerical calculations of the performance of the arc-driven supersonic mixing laser operating in the gas dynamic mode are compared with experimental results. A theoretical model of the $CS_2 + O_2$ flame laser has been set up. (auth)

14632 (AD-743051) DENSITY INHOMOGENEITY IN A LASER CAVITY DUE TO ENERGY RELEASE. Fuhs, A. E. (Naval Postgraduate School, Monterey, Calif. (USA)). May 1972. 11p. (NPS-57FU72051A). NTIS $3.00.

Density gradients, which refract laser light within the cavity, degrade beam quality. In addition to wall influences and viscous effects which cause density gradients, there is another mechanism. This mechanism, which is due to wakes and compression waves from heat (vibration energy to translation and rotation) addition in a supersonic stream, appears to have been overlooked. This appropriate equation is stated and discussed. A semigraphical solution procedure is outlined. Contours of constant density have been calculated for circular and rectangular cavities. Graphs of the isodensity contours are given. (auth)

14633 (AD-743999) CHEMICAL LASER NOZZLE FLOW DIAGNOSTICS. Report for October 1970–May 1971. Varwig, R. L. (Aerospace Corp., El Segundo, Calif. (USA)). 15 Feb 1972. Contract F04701-71-C-0172. 48p. NTIS $3.00.

Diagnostic techniques, including Schlieren, chemiluminescent photography, pitot pressure, and total temperature probes, have been evaluated and applied to the problem of determining the flow properties in the laser cavity of a supersonic diffusion laser system. For the present Schlieren system, the plenum pressure and temperature requirements are indicated. It is shown that chemiluminescent photography can provide shock pattern details in air-like gases for plenum temperatures of the order of 2000°K at pressures of about 1 atm. Seeding with gases can also provide information. Pitot pressure probes make possible the detection and tracking of shock waves and can, therefore, be used to determine if exit pressure and ambient pressure are matched. The measured total temperature and pitot pressure profiles were compared with theoretical predictions based on boundary layer growth. (auth)

14634 (AD-744947) ANALYTICAL INVESTIGATION OF THE EFFECT OF NOZZLE THROAT RADIUS OF CURVATURE ON GAS-DYNAMIC LASER GAIN. Wagner, J. L.; Anderson, J. D. Jr. (Naval Ordnance Lab., White Oak, Md. (USA)). 1 May 1972. 26p. (NOLTR-72-51) NTIS $3.00.

Numerical solutions for CO_2-N_2 gasdynamic laser gain and maximum available power are used to examine the influence of nozzle throat radius of curvature and throat height on laser performance. Conventional gasdynamic laser nozzles incorporate minimum length supersonic contours with sharp throats in order to obtain rapid vibrational freezing of the gas. The study considers the effect of complete rounding of the throat (on both the subsonic and supersonic sides), up to a radius of curvature equal to three throat heights. Such rounding allows easier manufacture and alignment of the nozzles, and should result in improved flow quality. The present results show a 15% reduction in laser gain and maximum available power due to complete rounding of the throat. (auth)

14635 (AD-746685) THEORETICAL PERFORMANCE OF AN HF CHEMICAL CW LASER. Report for July 1969–July 1971. Emanuel, G.; Cohen, N.; Jacobs, T. A. (Aerospace Corp., El Segundo, Calif. (USA)). 15 Feb 1972. Contract F04701-71-C-0172. 69p. NTIS $3.00.

A quantitative analysis of an HF cw chemical laser is presented that includes the influence of stimulated emission on the reacting medium. The numerically determined solutions encompass one-dimensional fluid mechanics, chemical kinetics, radiative de-excitation, and their mutual interaction. A comprehensive parametric study examines the effects due to changed plenum conditions, mixture ratios, and cavity parameters. Detailed discussions are presented of (1) vibration-vibration and vibration-translation energy exchange, (2) chemical efficiency, (3) mechanisms that cause lasing termination, and (4) cavity operation with a selective grating. (auth)

14636 (AD-746936) NUMERICAL ANALYSIS OF A GAS-DYNAMIC LASER MIXTURE. Munjee, S. A. (Washington Univ., Seattle (USA). Aerospace Research Lab.). 4 Oct 1971. Con-

tract F00014-67-A-0103-0008. 5p. Phys. Fluids; 15: No. 3, 506-510(Mar 1972).

A system of nonlinear vibrational relaxation equations for a CO_2-He-N_2 gas mixture is presented. Sample numerical results of mode temperatures and gain coefficient have been obtained for nozzle flows with a stagnation pressure of 20 atm. (auth)

14637 (AD-748178) ARPA-NRL LASER PROGRAM. Semi-annual Technical Report, 1 July–30 December 1971. (Naval Research Lab., Washington, D. C. (USA)). Aug 1972. 38p. (NRL-MR-2483). NTIS $3.00.

The ARPA-NRL high energy laser program is concerned with the development of laser technology in four program areas. Chemical lasers, electric discharge lasers; high power glass lasers, and new laser techniques. The report summarizes the progress made in those areas during the first half of FY 72. (auth)

14638 (AD-751499) PROBLEMS ASSOCIATED WITH THE IMPROVEMENT OF THE GAS-DYNAMIC LASER. Annual Report, 1 August 1971–31 July 1972. Christiansen, W. H. (Washington Univ., Seattle (USA). Aerospace Research Lab.). 31 Jul 1972. 87p. NTIS $3.00.

The development of the gasdynamic laser is one of the more important developments of the past decade. This laser, based on early works of Patel and others, obtains population inversion leading to laser action in CO_2-N_2 mixtures by rapid expansion of the gases to supersonic speeds. Relatively high powers, 0(60Kw), in cw operation have been achieved by this method, however, at very limited efficiency, 0(½ to 1%), based on radiated energy to flow enthalpy. It is the purpose of the current program to investigate methods for increasing this level of efficiency, the ideas of which may find application to other laser systems. The main objective of the program is to use a larger fraction of the total enthalpy of the laser fluid for lasing action in an open cycle system. The most straight-forward way to accomplish this is to efficiently expand the gas, lase, recompress and repeat this process as many times as possible. (NTIS)

14639 (AD-751694) CHEMICAL KINETICS AND FLUID MECHANICAL ASPECTS OF GAS LASERS. Final Summary Report, April 1969–May 1972. (Washington Univ., Seattle (USA). Aerospace Research Lab.). May 1972. Contract N00014-67-A-0103-0008. NTIS $3.00.

The effect of reducing the ratio of CO_2 to N_2 was primarily studied. A program of measurement of gain in expanding CO_2 laser mixtures at high pressure was carried out. Improved energy storage capability was successfully demonstrated through small signal gain measurements taken in a shock tube. This experimental approach allows the measurement of gain with various mixture ratios over a wide range of pressure conditions. (NTIS)

14640 (AD-755674) CALCULATIONS OF GAIN AND POWER OUTPUT FOR A GAS-DYNAMIC LASER. McLeary, R. 27 Mar 1972. 3p. IEEE J. Quant. Electron., QE8: No. 8, 716-718 (Aug 1972).

Revision of report dated 8 Dec 1971.

Detailed calculations of the coupled equations of nonequilibrium flow and the relevant molecular energy-exchange processes, have been carried out for a continuously operating CO_2 gas-dynamic laser system. Power outputs of about 100 kW/m length of nozzle throat at 1% efficiency with a small signal gain of 1/m are predicted. (auth)

14641 (AD-760132) SPECIE NUMBER DENSITY, PITOT PRESSURE, AND FLOW VISUALIZATION IN THE NEAR FIELD OF TWO SUPERSONIC NOZZLE BANKS USED FOR CHEMICAL LASER SYSTEMS. Final Report, 11 March 1971–5 May 1972. Whitfield, D. L.; Lewis, J. W. L.; Williams, W. D. (Arnold Engineering Development Center, Arnold Air Force Station, Tenn. (USA)). May 1973. 198p. (AEDC-TR-73-11). NTIS $3.00.

An experimental investigation of the gas dynamics in the near field of two supersonic nozzle banks used for chemical laser systems was conducted. The exhaust gases were simulated by mixtures of hydrogen, helium, and nitrogen. Pitot pressure measurements were made, and the electron beam fluorescence technique was used to obtain specie number density and flow visualization photographs. In addition, a few velocity measurements were made using the laser Doppler velocimeter measuring technique. An analytical investigation of the flow inside the nozzles for various reservoir conditions was also conducted. (auth)

14642 (AD-760390) INVESTIGATION OF OPTICAL GAIN IN GAS-DYNAMIC LASER MEDIA. Technical Report, 22 September 1971–31 July 1972. Russell, S.; Meinzer, R. A. (United Aircraft Research Labs., East Hartford, Conn. (USA)). Apr 1973. Contract F29601-71-C-0053. 90p. (UARL-L-911115-18). NTIS $3.00.

An experimental program was conducted using a small-scale, arc-augmented gas-dynamic laser with the objective of obtaining comprehensive data for evaluating theoretical predictions of optical gain for such devices over a wide range of potential operating conditions. Included among the program results were attainment of stagnation temperatures higher than those possible in ordinary combustion-driven gas-dynamic lasers, experimental evaluation of the homogeneity of the flow in this device and theoretical determination of the plenum gas composition from the experimentally measured stagnation temperature and pressure. A number of experimental difficulties were encountered during this program which limited the scope of the gain measurements obtained and thereby partially compromised the overall program objective. (auth)

14643 (AD-761601) INTERFEROMETRIC STUDIES OF THE FLOW IN FAST-EXPANDING NOZZLES. Leverance, R. A.; Zimet, E.; Winkler, E. M. (Naval Ordnance Lab., White Oak, Md. (USA)). 19 Mar 1973. 31p. (NOLTR-73-61). NTIS $3.00.

Interferometric studies have been performed in the test section of the Naval Ordnance Laboratory 127 mm shock tunnel under conditions that closely simulate the flow in a gas dynamic laser cavity. A Mach-Zehnder interferometer has been used to determine the density distribution in two nozzle configurations. In a two-dimensional fast-expanding nozzle, time-resolved interferograms were obtained at 200 microsecond intervals. For a multiple nozzle module interferograms were obtained in two mutually perpendicular directions. The experimental setup is described and the results are discussed. (auth)

14644 (AD-763255) GAS DYNAMICS OF CAVITIES-IN-SERIES GDL GAS DYNAMICS LASERS: SURVEY AND EXTENSION. Murthy, S. N. B. (Purdue Univ., Lafayette, Ind. (USA)). Jan 1973. Contract DAAH01-72-C-0864. 135p. NTIS $5.45.

In the development of large gas dynamic lasers (GDL) which are required to be mobile and possibly airborne, the problem of assuring a positive start of the system without exhaust pumps becomes of great importance, especially when laser power extraction is sought to be increased by the use of cavities-in-series. A morphological analysis of such systems as well as a method of determining the transient states during a starting process is presented with a brief account of the current status of the gas dynamic lasers. It is concluded that there are no problems which may basically prevent the adoption of cavities-in-series configurations in GDL; however, each system has to be optimized with respect to the expansion and cavity dynamics as well as the cavity optics. (auth)

14645 (AD-763828) AERODYNAMIC REACTIVE FLOW STUDIES OF THE H_2/F_2 LASER. Technical Report, 16 October 1971–15 February 1973. Witte, A. B.; Broadwell, J. E.; Shackleford, W. L.; Trost, J. E.; Jacobs, T. A. (TRW Systems Group, Redondo Beach, Calif. (USA)). Jun 1973. Contract F29601-72-C-0021. 241p. NTIS $3.00.

The research investigated experimentally and theoretically the mixing process and its influence on performance of a continuous H_2-F_2 laser. In the experimental investigation, detailed flow field and chemical species measurements were made in the reaction zone of two parallel flow injector configurations. A hydrogen spray bar injector configuration, similar to many of today's operating chemical lasers, was also tested, but to a lesser extent. For the parallel configuration, one important experimental result was the identification of laminar, transitional, and turbulent regions for the mixing reaction zone. In the theoretical investigation, a simplified theory of a mixing limited production of vibrationally excited HF was constructed. A closed form expression was developed which shows the effects of pertinent flow parameters on laser performance and on HF concentrations for nonlasting cases. (auth)

14646 (AD-763898) ARC-DRIVEN N_2CS_2 MIXING GAS-DYNAMIC LASER. Roberts, T. G.; Morgan, R. L. (Army Missile Command, Redstone Arsenal, Ala. (USA)). 30 Apr 1973. 20p. (RR-73-3). NTIS $3.00.

The arc-driven laser facility was made available for a brief period while the high energy pulsed laser was down, and an attempt was made to operate the facility as an $O_2 + CS_2$ chemical laser where the hot N_2 from the arc was to disassociate the O_2 in the plenum and $He + CS_2$ was to be mixed with these gases in the supersonic mixing mode. However, at no time was lasing obtained when the laser was operated in this mode; but, when O_2 was omitted from the plenum due to a failure to operate the O_2 Marotta valve, lasing was obtained when $He + CS_2$ was mixed with only nitrogen in the supersonic mixing mode. The results which were obtained during this brief period of experimentation are presented in this report. (auth)

14647 (AD-763905) DEVELOPMENT AND APPLICATION OF ANALYTICAL MODELS FOR CHEMICAL LASERS. Part I. Final Report. Thoenes, J.; Ratliff, A. W. (Lockheed Missiles and Space Co., Huntsville, Ala. (USA)). May 1973. Contract DAAH01-72-C-0493. 116p. NTIS $5.45.

A new laser and mixing analysis is described which considers the coupling between gasdynamic properties, cavity characteristics, and resulting laser radiation for diffusion-type chemical laser oscillator cavities. The formulation assumes parallel mixing and constant lateral pressure with lasing due to single or multiple transitions between certain vibrational/rotational molecular energy levels. Excitation of the active medium traversing a Fabry-Perot optical cavity is caused by highly exothermic reactions between gradually mixing reactants discharged from a grid nozzle. Uniform, premixed, inviscid laser cavity flows can be investigated as a special case of the more general analysis. Typical results are given for both uniform premixed and gradually mixing two-dimensional cavity flows. Volume I of this two-part final report documents the work accomplished on the development of the gain and power calculations, radiation model and its implementation into the constant lateral pressure Laser and Mixing Program (LAMP). (auth)

14648 (AD-765049) MDI: THE TRANSFER CHEMICAL LASER. A Review of Recent Research. Cool, T. A. (Naval Research Lab., Washington, D. C. (USA)). 8 Aug 1972. 12p. IEEE J. Quant. Electron.; QE9: No. 1, 72-83(Jan 1973).

Revision of report dated 30 Jun 1972.

Selective vibrational energy transfer to a second molecule (e.g., CO_2) has been the basis for the development of the transfer chemical laser (TCL) during the past three years. A summary of recent progress in the development of cw and pulsed DF-CO_2 transfer chemical lasers is presented. An experiment designed to produce multikilowatt supersonic DF-CO_2 chemical laser operation with full atmospheric recovery in the exhaust gases is discussed. Recent measurements of key vibrational energy transfer processes are reviewed; such measurements have greatly clarified the kinetic aspects of the HF, DF, HF-CO_2, DF-CO_2, HCl-CO_2, and HBr-CO_2 chemical lasers. (auth)

14649 (AD-767190) PERFORMANCE OF TRIPLE SLIT NOZZLE FOR CHEMICAL LASER APPLICATIONS. Report for September 1971–March 1972. Durran, D. A.; Varwig, R. L. (Aerospace Corp., El Segundo, Calif. (USA)). 28 Sep 1973. Contract F04701-73-C-0074. 39p. NTIS $4.00.

A triple slit nozzle was constructed for use on a continuous, diffusion-type, HF chemical laser. In this nozzle, a primary supersonic stream of He, F, and F_2 is separated from the H_2 stream by a buffer stream of He. When the primary stream contains large amounts of F_2, either because the dissociation level is down or because there is less diluent, the buffer stream serves to reduce the severity of the reaction between F_2 and H_2 near the nozzle exit plane. The results of measurements of the flow properties of the triple slit nozzle and its use in an SF_6 laser are discussed. (auth)

14650 (AD-767192) EXPERIMENTAL CW CHEMICAL LASER STUDIES. Report for July 1970–June 1971. Spencer, D. J.; Varwig, R. L. (Aerospace Corp., El Segundo, Calif. (USA)). 15 Sep 1973. Contract F04701-73-C-0074. 47p. NTIS $3.00.

Experimental studies of continuously operating diffusion-type HF chemical lasers are presented. Nonuniform flow profiles at the laser nozzle exit are deducted by the use of pitot and total-temperature probes. The presence of shock waves and the measured flow profiles were of particular interest in the explanation of laser performance under varied flow conditions. Low-diluent-ratio flows resulted in a deterioration of laser performance partly because of thermal blockage effects. Alternate nozzles were plugged in order to provide lateral jet expansion relief, which resulted in improved laser performance. Pressure scaling was investigated up to approximately 5 atm plenum pressure and 16-torr cavity pressure. For fixed plenum conditions, an increase in cavity pressure resulted in a decrease in laser power and axial lasing length (due to oblique shocks and nozzle separation). For fixed cavity pressure, an increase in plenum pressure resulted in an increase in power and axial lasing length (due to a reduced boundary layer). The cavity pressure for peak power corresponded quite closely to the cavity pressure predicted for matched nozzle flow. (auth)

14651 (AD-767193) MEASUREMENT AND ANALYSIS OF THE HF RADIATION FROM A REACTING SUPERSONIC JET. Report for January 1971–January 1972. Kwok, M. A. (Aerospace Corp., El Segundo, Calif. (USA)). 15 Sep 1973. Contract F04701-73-C-0074. 64p. NTIS $3.50.

The spontaneous emission from HF infrared bands in the free jet of a continuous HF chemical laser with a slit nozzle bank has been measured at a number of downstream positions. Three cases are reported: (1) high-power flow that includes O_2, (2) without O_2, and (3) with reduced SF_6. Spatially averaged number densities of the HF vibrational levels (v = 1, 2, 3, 4) have been determined for the zero-power case. Vibrational nonequilibrium is evident. Observed rotational temperatures range from 560 down to 400°K. Gain coefficients are deduced. Data have been fitted to both a one-dimensional, constant-pressure streamtube jet model and a two-dimensional model; the best fit occurs with the latter. Deactivation plays an important role in determining the average gain. The principal deactivator of HF(v) is H. Other important deactivation mechanisms are vibration-vibration transfers with HF or H_2. (auth)

14652 (AD-767921) ARPA-NRL LASER PROGRAM. Semiannual Technical Report, 1 July–31 December 1972. (Naval Research Lab., Washington, D. C. (USA)). Jun 1973. 68p. (NRL-MR-2634). NTIS $3.50.

The ARPA-NRL high energy laser program is concerned with the development of laser technology in four program areas, i.e., chemical lasers, electric discharge lasers; and high power glass laser techniques. The chemical laser program has consisted of primarily two experiments; the development of a DF-CO_2 supersonic transfer laser, and the study of the CO vibrational distribution from the reaction O + CS. Assembly of the amplifier chain of the short pulse CO_2 laser system has continued. Under the new laser techniques program a pulsed OD-CO_2 transfer laser has been operated for the first time. The high power glass laser is operating reliably and over 2000 shots have been fired during the last reporting period. This has permitted statistics to be compiled on the laser's performance and initial laser-target interaction experiments to be carried out. (auth)

14653 (AD-772643) CH/CD cw CHEMICAL LASER STUDIES AND NEW SUPERSONIC FLOW LASER GEOMETRIES. Part 2. The Radial Flow Chemical Laser. Final Technical Report, 1 July 1972–30 September 1973. Falk, T. J. (Calspan Corp., Buffalo, N. Y. (USA)). 21 Apr 1972. Contract N00014-72-C-0460. 58p. NTIS $6.00.

The fluid mechanical aspects of radial supersonic flow lasers are discussed and various design constraints applying to these lasers are analyzed. Estimates are presented which indicate the circumstances under which radial supersonic nozzle and laser optical cavity flow fields are expected to differ significantly from corresponding linear flow fields. Supersonic nozzle shapes are expected to be influenced by radial flow when the radius at the nozzle exit is less than about four times the height of an individual nozzle element. The influence of radial flow upon the flow field in the laser optical cavity depends upon the laser radius, the chemical heat release in the cavity and the streamwise length of the gain region. (auth)

14654 (AD-772777) INVESTIGATIONS OF THE EFFECT OF COMBUSTOR GEOMETRY AND END NOZZLE FLOW ON THE PERFORMANCE OF GDL (GAS DYNAMIC LASER) TYPE DIFFUSERS. Final Report, 17 January–17 July 1973. Mensing, A. E.; Zumpano, F. R. (United Aircraft Research Labs., East Hartford, Conn. (USA)). Nov 1973. Contract F33615-73-C-4077. 53p. NTIS $3.75.

An investigation was conducted to determine some of the performance characteristics of a high aspect ratio supersonic diffuser typical of those employed on gas dynamic laser devices. The experimental investigations were conducted in a sub-scale, cold flow test rig having the same Mach number and Reynolds number as the full scale Split Stage Demonstrator (SSD). Experiments and analysis were performed to determine the effect on diffuser performance of variations of the flow duct geometry upstream of the nozzle array and the effect of increased flow rate through the end nozzles of the array. Diffuser performance was determined from experimental measurements of the pressures in the simulated combustor and at the diffuser exit. (auth)

14655 (AD-773719) GAS-DYNAMIC AND KINETIC PHENOMENA IN CHEMICAL LASERS. Annual Report, 28 September 1972–27 September 1973. Skifstad, J. G.; Chao, C. M.; Park, S. C. (Purdue Univ., Lafayette, Ind. (USA). School of Mechanical Engineering). 15 Dec 1973. Contract DAAH01-73-C-0167. 25p. NTIS $3.00.

The first year's research effort to gain an improved understanding of the importance of gasdynamic and kinetic phenomena in chemical lasers is summarized. A survey of gasdynamic phenomena in chemical lasers was prepared and presented at the Fourth International Colloquium on Gasdynamics of Explosions and Reactive Systems, July, 1973, at La Jolla. The remainder of the activity, summarized in this report, comprised a study of rotational relaxation kinetics as they influence saturation and preparation of a bibliography on the optical properties of HF and

DF. More general gaskinetic theories and possible reasons for interest in them with application to chemical lasers are also discussed. (auth)

14656 (AD-773899) QUASI-STEADY STATE CO_2 LASER WITH PULSE EXCITATION. Kanaev, I. F.; Kruglyakov, F. P.; Malinovskii, V. K. Translated by R. E. Zarza from Zh. Prikl. Mekh. Tekh. Fiz.; No. 5, 171-173(1971). 10p. NTIS $4.00.

A number of methods make it possible to obtain significant values of the population inversion in lasers in a CO_2-N_2-He mixture. In this research a laser model is described which is associated predominantly with pulse excitation of molecules in a discharge with a nonequilibrium emission of a supersonic jet in a vacuum. (NTIS)

14657 (AD-773975) INVESTIGATION OF HIGH POWER MHD GAS LASERS. Annual Report, 1 January-31 December 1973. Zauderer, B.; Tate, E.; Marston, C. H. (General Electric Co., Philadelphia, Pa. (USA). Space Div.). 31 Dec 1973. Contract N00014-73-C-0243. 50p. NTIS $3.25.

The primary objective of this year's effort, the achievement of optical gain in an MHD channel, has been met. Gain of 0.2%/cm at 10.6 micrometers has been repeatedly measured in two gas mixtures He/Ne/CO_2/Xe and He/Ar/CO_2/Cs. (NTIS)

14658 (AD-774135) SENSITIVITY OF GAS-DYNAMIC LASER CALCULATIONS TO UNCERTAINTIES IN KINETIC RATES. Anderson, J. D. Jr. (Maryland Univ., College Park (USA)). Oct 1973. 56p. NTIS $3.75.

Recent data for the vibrational energy exchange rates associated with CO_2-N_2-H_2O gas lasers are compared with previous compilations. From this, current uncertainties in the rate data are established. Using an existing computer code, a study is made of the sensitivity of gasdynamic laser performance to these uncertainties. The results show that present-day calculations of gasdynamic laser gain and maximum available power are subject to at least a 25% inaccuracy due to such rate data uncertainties. (auth)

14659 (AD-774391) INVESTIGATION OF DIFFUSERS FOR GAS-DYNAMIC LASER NOZZLES. Clawson, D. G. (Air Force Inst. of Tech., Wright-Patterson AFB, Ohio (USA)). Dec 1973. 36p. (GAM-ME-73A-3). NTIS $5.00.

Thesis.

Schlieren photographs were used to analyze the flow characteristics of diffusers for a Mach 6.0 double nozzle assembly. This assembly of two nozzles, comprised of one full center and two half side channels, was more conducive to greater boundary layer growth than a nozzle assembly with more nozzle throats. Schlieren photographs of the air flow were in line with the laser beam's orientation to the nozzles of a gas dynamic laser. Dry air at 85°F total temperature, and 120 psia total pressure was expanded with a nozzle area ratio of 66.0. Different diffuser configurations were tried to determine the diffuser throat area required to start the cavity. It was determined that the cavity would start when the ratio of diffuser throat area to channel cross-sectional area was near 0.6, which is in agreement with other studies, considering the presence of wakes in the flow. Boundary layer growth is accelerated at these high Mach numbers, limiting the distance between the nozzles and diffuser; excellent optical charity flow was obtained emerging from the nozzles and close to the channel center using a multi-element diffuser, but, deteriorates rapidly further downstream. (auth)

14660 (AD-774942) MIXING AND REACTION IN HIGH SPEED H_2-F_2-DILUENT FLOWS FOR USE WITH SUPERSONIC PULSED HF LASERS. Thayer, W. J. III; McClure, J. D. (Boeing Aerospace Co., Kent, Wash. (USA)). Aug 1973. Contract N60921-72-C-0356. 113p. (D-180-17608-1). NTIS $8.75.

Rationale for supersonic pulsed chemical lasers and problem areas related to design and use of associated reagent premixers are described. An analytical model of reagent mixing and reaction for evaluation of "prereaction" and mixing characteristics of high enthalpy H_2-F_2-diluent flows is formulated and programmed for computer solution. The code is used to evaluate parametric dependence of prereaction level and required mixing length on principal parameters defining candidate premixer flows. Possible flow choking and subsequent detonation in the mixing region resulting from reacting flow transients following a fast laser-reaction pulse are examined, both by defining conditions under which choking by chemical heat addition and/or Chapman-Jouguet detonations are energetically allowed, and by using a simplified reacting flow model to estimate kinetic limitations on probable occurrence of such disturbances. (auth)

14661 (AD-775411) CHEMICAL LASER ANALYSIS DEVELOPMENT. Volume I. Laser and Mixing Program Theory and User's Guide. Final Report, 24 October 1972-24 October 1973. Thoenes, J.; McDanal, A. J.; Ratliff, A. W.; Smith, S. D. (Lockheed Missiles and Space Co., Huntsville, Ala. (USA)). Oct 1973. Contract DAAH01-73-C-0232. 147p. (LMSC-HREC-TR-D-306900-1). NTIS $4.75.

A new Laser and Mixing Program (LAMP) is described which considers the coupling between gasdynamic properties, cavity characteristics, and resulting laser radiation for diffusion-type chemical laser oscillator cavities. The formulation assumes parallel mixing and constant lateral pressure with lasing due to single or multiple transitions between certain vibrational/rotational molecular energy levels. Excitation of the active medium traversing a Fabry-Perot optical cavity is caused by highly exothermic reactions between gradually mixing reactants discharged from a grid nozzle. Uniform, premixed inviscid laser cavity flows can be investigated as a special case of the more general analysis. The report contains a description of the analysis as well as a user's manual. (auth)

14662 (AD-775412) CHEMICAL LASER ANALYSIS DEVELOPMENT. Volume II. Two-Dimensional Fresnel Integral Laser and Mixing Program User's Guide. Final Report, 24 October 1972-24 October 1973. Thoenes, J.; South, C.; Rensch, D. B. (Lockheed Missiles and Space Co., Huntsville, Ala. (USA)). Oct 1973. Contract DAAH01-73-C-0232. 86p. (LMSC-HREC-TR-D-306900-2). NTIS $4.00.

The Two-Dimensional Fresnel Integral Laser and Mixing Program (TDFI-LAMP) is described. This computer program represents a combination of the Hughes' developed Fresnel Integral Computer Program (FICP) and the Lockheed-developed Laser and Mixing Program (LAMP), thereby providing a sophisticated tool for the study of the interrelated gasdynamic and optical properties of chemical laser resonators. (auth)

14663 (AD-775413) CHEMICAL LASER ANALYSIS DEVELOPMENT. Volume III. Lockheed One-Dimensional Laser and Mixing Program Guide. Final Report, 24 October 1972-24 October 1973. Mikatarian, R. R.; Ring, L. R. (Lockheed Missiles and Space Co., Huntsville, Ala. (USA)). Oct 1973. Contract DAAH01-73-C-0232. 52p. (LMSC-HREC-TR-D-306900-3). NTIS $3.75.

The Lockheed One-Dimensional Laser and Mixing Program (ODLAMP) is described for analyzing multi-species lasing in a chemically reacting one-dimensional stream with mass addition. Mass is assumed to be injected (at a prescribed rate) from each of two separate streams, into a primary lasing stream. Lasing due to p-transitions (i.e., transitions proceeding from (v + 1, J-1) to (v, J)) is treated. Both the analysis and computer programs are presented, including an input guide, sample calculation and flow chart. (auth)

14664 (AD-775414) CHEMICAL LASER ANALYSIS DEVELOPMENT. Volume IV. Method of Characteristics Laser and Mixing Program Theory and User's Guide. Final Report, 24 October 1972-24 October 1973. Ratliff, A. W.; Thoenes, J.; Smith, S. D. (Lockheed Missiles and Space Co., Huntsville, Ala. (USA)). Oct 1973. Contract DAAH01-73-C-0232. 93p. (LMSC-HREC-TR-D-306900-4). NTIS $4.00.

A new laser and mixing computer program is described which considers the coupling between gasdynamic properties, cavity characteristics, and resulting laser radiation for diffusion-type chemical laser oscillator cavities. The formulation assumes nonuniform mixing with lateral pressure gradients and lasing due to a single transition between the upper and lower laser levels. Excitation of the active medium traversing a Fabry-Perot optical cavity is caused by highly exothermic reactions between gradually mixing reactants discharged from a grid nozzle. Uniform, premixed inviscid laser cavity flows can be investigated as a special case of the more general analysis. (auth)

14665 (AD-775415) CHEMICAL LASER ANALYSIS DEVELOPMENT. Volume V. Reaction Models and Analysis. Final Report, 24 October 1972-24 October 1973. Kurzius, S. C.; McDanal, A. J.; McDermit, J. H.; Mikatarian, R. R.; Ratliff, A. W. (Lockheed Missiles and Space Co., Huntsville, Ala. (USA)). Oct 1973. Contract DAAH01-73-C-0232. 141p. (LMSC-HREC-TR-D-306900-5). NTIS $4.75.

Chemical kinetics inputs and the results of analyses undertaken are presented in support of the development and application of numerical models for the evaluation of supersonic flow chemical laser performance. Reactions and rate coefficients in use to develop reaction models for H_2-F_2, H_2-F_2-CO_2, H_2-F_2-NO-HI, D_2-F_2 and D_2-F_2-CO_2 chemical lasers are listed and discussed. Detailed results of parametric studies of an H_2-F_2 direct combustion chemical laser device and of a D_2-F_2-CO_2 transfer chemical laser device are discussed, stressing the potentially important role of the "hot" reaction (H (or D) + F_2 yields HF(v) + F) and of realistic modeling of optical losses, nozzle velocity profiles and, especially, laminar/turbulent fuel/oxidizer mixing rates. An

analysis incorporating the production, dissipation and diffusion of turbulent kinetic energy is presented which is shown to realistically model laminar/turbulent mixing in chemical laser cavity flows. Finally, an exploration attempt to use the error minimization technique for chemical laser numerical analysis is described. (auth)

14666 (AD-775416) CHEMICAL LASER ANALYSIS DEVELOPMENT. Volume VI. Survey of Pressure Recovery Methods for Chemical Laser Application. Final Report, 24 October 1972-24 October 1973. Baker, I. R. Jr.; McDermit, J. H. (Lockheed Missiles and Space Co., Huntsville, Ala. (USA)). Oct 1973. Contract DAAH01-73-C-0232. 53p. (LMSC-HREC-TR-D-306900-6). NTIS $3.75.

Available data on pressure recovery devices is assembled and analyzed and their suitability assessed for application to chemical laser systems. Performance of unaugmented gasdynamic diffusers are examined and potential devices are reviewed for augmenting (or pumping) the diffuser exhaust gases. Recommendations are made concerning the most attractive pressure recovery technique, and realistic goals for operation of the chemical laser cavity commensurate with pressure recovery technology. (auth)

14667 (AD-775417) CHEMICAL LASER ANALYSIS DEVELOPMENT. Summary Volume. Final Report, 24 October 1972-24 October 1973. Benefield, J. W. (Lockheed Missiles and Space Co., Huntsville, Ala. (USA)). Oct 1973. Contract DAAH01-73-C-0232. 52p. (LMSC-HREC-TR-D-306900-S). NTIS $3.75.

The general objectives of this effort were to improve the analytical tools available for studying chemical lasers and to apply these tools to further the understanding of chemical lasers. Four computer programs are described: (1) One-Dimensional Laser and Mixing Program (ODLAMP); (2) Laser and Mixing Program (LAMP); (3) Two-Dimensional Fresnel Integral Laser and Mixing Program (TDFI-LAMP); and (4) Method-of-Characteristics Laser and Mixing Program (MOC-LAMP). Selected highlights are presented of the computer codes, analyses, results, conclusions and recommendations. The results presented include the effects of fuel/oxidizer ratios, cavity pressure, mixing, optical characteristics, mode of operation, boundary layer and an assessment of the relationship of chemical laser cavity conditions to pressure recovery methods. (auth)

14668 (AD-777420) SELECTED TRANSLATIONS. Translated from Zh. Prikl. Mekh. Tekh. Fiz.; No. 5, 24-45, 171-173 (1971). 54p. NTIS $5.75.

The population inversion of CO_2 molecules in expanding gas flows; screening of a surface vaporized by the effects of laser emission in temperature and ionization non-equilibrium; and a quasi-stationary CO_2 laser with "pulsed" stimulation are discussed. (NTIS)

14669 (AD-781353) OPERATION OF A SMALL SINGLE-MODE STABLE cw HYDROGEN FLUORIDE LASER. Hinchen, J. J. (United Aircraft Research Labs., East Hartford, Conn. (USA)). 17 Dec 1973. Contract F44620-70-C-0114. 5p. J. Appl. Phys.; 45: No. 4, 1818-1821(Apr 1974).

A small hydrogen fluoride mixing laser has been developed which produces cw radiation with excellent short-term amplitude stability (variation less than plus or minus 1.5%) and requires only 14 liter/sec pumping capacity. Using a grating and a semitransparent mirror mounted on a piezoelectric crystal for laser cavity optics, the laser has been made to operate on a single molecular transition and also on a single cavity mode. By varying the cavity length it was possible to tune the laser over about 300 MHz. The gain of the laser was established at about 30% by measurement of mode pulling and also by direct gain measurement. (auth)

14670 (AD-781437) APPROXIMATE DETERMINATION OF INVERSION POPULATION AND OF THE AMPLIFICATION FACTOR OF GAS DURING ADIABATIC EXPANSION IN THE NOZZLE. Gembarzhevskii, G. B. Translated from Zh. Prikl. Mekh. Tekh. Fiz.; No. 3, 35-40(1973). 9p. (NISC-TRANS-3549). NTIS $4.00.

Analytical expressions are derived for the power dependence and amplification factor of a gasdynamic laser upon the shape and dimensions of the nozzle, deceleration parameters, and gas content valid for a wide scale of changes in these parameters These analytical expressions were obtained by means of calculating the dependence of kinetic equation coefficients upon time. (NTIS)

14671 (AD-781442) LIGHT AMPLIFICATION IN A PULSED GAS-DYNAMIC LASER USING ACETYLENE-AIR COMBUSTION PRODUCTS. Kozlov, G. I.; Ivanov, V. N.; Korablev, A. S. Translated from Zh. Eksp. Teor. Fiz.; 65: No. 1, 82-88(1973). 11p. NTIS $4.00.

The amplification coefficients for the products of burning acetylene-air mixtures and expansion through a supersonic nozzle were measured as functions of the stagnation parameters and the acetylene concentration in the original mixture. The largest amplification coefficient is 0.006/cm, which is nearly three times greater than the predicted value for the particular nozzle geometry. It is shown that when a shock wave propagates in a gas having a population inversion there is an initial increase in the amplification followed by a rapid transition from amplification to absorption. (NTIS)

14672 (AD-782226) CO_2 MHD LASER: ANALYSIS, DESIGN, AND SHOCK TUNNEL EXPERIMENTS. Zauderer, B.; Tate, F.; Marston, C. H. (General Electric Co., Philadelphia, Pa. (USA). Space Div.). May 1974. Contract N00014-73-C-0243. 8p. (ONR-TR-19). NTIS $3.00.

MHD laser gain exceeding 0.2%/cm has been achieved in the GE/ONR shock tunnel using a mixture of 78% He, 18% Ar and 4% CO_2 with either 1% Xe or 0.1% Cs added to the basic mixture for seeding. Long relaxation times and non-emitting electrodes required use of some external voltage augmentation to achieve the necessary plasma conditions in the available generator length. The MHD laser analysis, design of a channel based on that analysis, and experimental results to date are discussed. (auth)

14673 (AD-785667) MIXING GAS-DYNAMIC LASERS. Roberts, T. G. (Army Missile Command, Redstone Arsenal, Ala. (USA)). 1973. 14p. NTIS $3.25.

Results obtained with an arc-driven gas dynamic laser (GDL) having an aerodynamic nozzle designed so that cold CO_2 or other gases can be injected either into the expanding N_2 flow before it reaches the nozzle exit (supersonic mixing mode) or into the flow just before it reaches the nozzle throat (near-sonic mixing mode) are reported. The gases can also be premixed either before or upon injection into the plenum (GDL mode). The results obtained in the GDL mode with marginal plenum conditions are compared with those obtained in the supersonic and near-sonic mixing modes using cold CO_2. Preliminary results are also given for operation in the supersonic mixing mode when a mixture of cold CS_2 and He is injected into the N_2 flow. The laser is described and the results are presented and discussed. (NTIS)

14674 (AD-785911) INVESTIGATION OF HIGH POWER MHD GAS LASERS. Semiannual Report, January-August 1974. Zauderer, B.; Tate, E.; Marston, C. H. (General Electric Co., Philadelphia, Pa. (USA). Space Div.). Aug 1974. Contract N00014-74-C-0243. 31p. NTIS $3.75.

This report presents the results obtained during the first half of the year 1974 in the study of MHD powered gas lasers. Key results of the work thus far are: Changes to the shock tunnel and test facility include a modified cesium seed injection system, relocation of the secondary diaphragm, installation of a primary double diaphragm and a new CO_2 probe laser. Gain measurements previously reported have been repeated, with substantial improvement in the signal attributable to the above changes. Achievement of 19% enthalpy extraction in the MHD generator channel is an important step forward in generator performance. (auth)

14675 (AD-786077) GAS-DYNAMIC PHENOMENA IN CHEMICAL LASERS. Skifstad, J. G. (Purdue Univ., Lafayette, Ind. (USA). School of Mechanical Engineering). 26 Sep 1973. Contract DAAH01-73-C-0167. 33p. Acta Astronautica; 1: 781-812 (1974).

The report attempts to provide an outline of some aspects of chemical lasers which seem likely to be ones where the gas dynamicist can make substantial contributions. Some phenomena in both pulsed and cw devices are included. The discussion falls into four parts: gas-kinetic phenomena, gas-dynamic aspects of premixed systems, diffusion flames, and nozzle flow. (NTIS)

14676 (AD-786463) EXPERIMENTAL INVESTIGATION OF THE FLOW IN AN INTERSTAGE CONNECTING DUCT FOR USE ON A HIGH POWER GAS-DYNAMIC LASER. I. Gas Chromatograph Studies. Golobic, R. A.; Quick, D. H. (Frank J. Seiler Research Lab., U.S.A.F. Academy, Colo. (USA)). Aug 1974. 35p. NTIS $3.75.

A model of a duct used to optically connect to high-power gas-dynamic lasers was tested employing the USAF Academy trisonic wind tunnel. The wind tunnel was used as the cold flow simulation of the laser operating at Mach numbers of 3.5 and 4.5, and at test section static pressures of 0.5 to 0.8 torr, and a mock-up of one half of the laser duct was attached to the wind tunnel test section. Gas chromatograph analysis of the flow composition at several locations in the duct resulted in the determination of the proper helium purge gas mass flow out of the duct which was necessary to keep the duct free of laser gas. The necessary purge gas mass flow was found to be sufficiently low enough so as not to adversely

affect the laser diffuser performance. A similarity parameter allows correlation to actual laser conditions. (auth)

14677 (AD/A-000928) GAS-DYNAMIC RECOMBINATION LASER. Final Report, October 1972- September 1973). Wilson, J. (Aderam-Assipra, Marseille (France)). Nov 1973. 47p. NTIS $3.75.

The possibility is discussed of a gasdynamic laser using dissociation as the frozen mode, rather than vibration, and which would lase following recombination. Such a laser has the potential of high power, high efficiency, and visible wavelengths. Several reactions are considered, and recombination to form molecular bromine, chlorine and nitrogen dioxide were considered most suitable. Calculations of expected gain are presented. Unfortunately rapid deactivation by atoms destroys the promise of the chlorine and bromine systems. Experiments performed in a shock tunnel generated no laser action in either chlorine or nitrogen dioxide. Recombination to molecular oxygen does not suffer from deactivation by atoms, but has too low a gain to achieve laser action in the apparatus available. (NTIS)

14678 (AD/A-005566) BIBLIOGRAPHY OF SOVIET LASER DEVELOPMENTS, NO. 17, JULY-SEPTEMBER 1974. Hibben, S. G. (Informatics, Inc., Rockville, Md. (USA)). 29 Jan 1975. Contract N00600-75-C-0018. 110p. NTIS $5.25.

See also No. 16, AD/A-000270.

This is the Soviet Laser Bibliography for the third quarter of 1974 and is No. 17 in the series on Soviet laser developments. The coverage includes basic research on solid state, liquid, gas, and chemical lasers; components; nonlinear optics; spectroscopy of laser materials; ultrashort pulse generation; crystal growing; theoretical aspects of advanced lasers; and general laser theory. Laser applications are listed under biological effects; communications; computer technology; holography; laser-induced chemical reactions; instrumentation and measurements; beam-target interaction; and plasma generation and diagnostics. (GRA)

14679 (AD/A-005627) DEVELOPMENT OF MULTIPLY SENSITIZED Ho:YLF AS A LASER MATERIAL. Final Report, 15 December 1972-15 January 1974. Chicklis, E. P.; Folweiler, R. C.; Naiman, C. S.; Gabbe, D. R.; Linz, A. (Sanders Associates, Inc., Nashua, N. H. (USA). Electro-Optical Div.). Oct 1974. Contract DAAB07-73-C-0066. 130p. (YWN-5126(Rev.1)). NTIS $5.75.

See also report dated Jan 1973, AD-755530.

The results of a 12-month program to develop multiply sensitized Ho:YLF as a Q-switched laser material are presented. This material is the only material in which efficient laser operation at 2 μm has been reported at room temperature. Crystals were grown by the Top-Seeded Solution Technique, a modification of the Czochralski process. Extensive analysis of the effects of feed purity and growth technique on the crystalline quality and damage susceptibility of this material are presented. Extensive spectroscopic measurements are reported with direct observation of sensitization quantum yields of three; the implications for optimization of the material for specific applications are discussed. Q-switched operation of different material compositions is reported (calcite with $LiNbO_3$). The composition 50% Er, 6.7% Tm, 0.34% Ho has exhibited a 6.5 J threshold and a 2.5% slope efficiency. A calculation of the thermal loading at fracture of a uniformly heated rod cooled at the surface is presented. (GRA)

14680 (AD/A-005652) AIRBREATHING LASER PROOF EXPERIMENT. Final Technical Report, 6 June-16 September 1974. Gordon, R. W.; McCloskey, J. M. (Pratt and Whitney Aircraft, West Palm Beach, Fla. (USA). Florida Research and Development Center). 31 Jan 1975. Contract DAAH01-74-C-0751. 55p. NTIS $4.25.

An experimental test program to measure the predicted performance of a gas dynamic laser burning benzene, toluene, and kerosene in preheated air is described. Small signal gain and power extraction measurements were made with each of the three hydrocarbon fuel-air combinations and compared with predicted values. The combustor was monitored for smoke-free operation by measurement of the attenuation of a 3.391 micron beam in the optical cavity. The combustor, originally designed to burn gaseous $CO/H_2/O_2/N_2$ reactants, was redesigned and retrofitted for smokeless burning of the liquid hydrocarbons with preheated air. Small signal gain up to 0.484+/cm and output power up to 22.6 kW were measured. (NTIS)

14681 (AD/A-006204) FINE ORIFICE INJECTOR DEVELOPMENT. Final Report, 27 December 1972-15 November 1974. Vieceli, J. J. (Army Missile Command, Redstone Arsenal, Ala. (USA)). Nov 1974. Contract DAAH01-73-C-0408. 226p. NTIS $7.50.

The operating characteristics of a supersonic mixing transfer chemical laser (TCL) have been experimentally determined. The performance of the TCL has been determined for a wide range of operating conditions using a fixed supersonic mixing chemical laser nozzle bank. The important parameters are: nozzle configuration; nozzle exit conditions; (exit pressure and exit temperature); composition (fluorine available for lasing, fracture of fluorine dissociated, He molar flow ratio, laser fuel flow ratio, and CO_2 molar flow ratio); cavity flow conditions (cavity pressure); and resonator parameters. Most of the experimental effort reported was devoted to the DF-CO_2 TCL. (NTIS)

14682 (AD/A-006298) INVESTIGATION OF HIGH POWER MHD GAS LASERS. Semiannual Report, September 1974-January 1975. Zauderer, B.; Tate, E.; Marston, C. H. (General Electric Co., Philadelphia, Pa. (USA). Space Div.). Jan 1975. Contract N00014-74-C-0243. 20p. NTIS $3.25.

Results obtained during the second half of the year 1974 in the study of MHD powered gas lasers are reported. Key results of the work thus far are: (1) changes to the shock tunnel and test facility include a modified cesium seed injection system, relocation of the secondary diaphragm, installation of a primary double diaphragm and a new CO_2 probe laser; (2) gain measurements previously reported have been repeated, with substantial improvement in the signal attributable to the above changes; and (3) achievement of 19% enthalpy extraction in the MHD generator channel is an important step forward in generator performance. (auth)

14683 (AD/A-006967) ANALYTIC CALCULATIONS FOR ELECTRICALLY EXCITED D_2/HCl LASER. Technical Report, 1 August-31 October 1974. Taylor, R.; Caledonia, G.; Lewis, P.; Teare, J. D. (Physical Sciences, Inc., Wakefield, Mass. (USA)). 3 Feb 1975. Contract N00014-75-C-0035. 43p. (PSI-TR-18). NTIS $3.75.

Analytical modeling of an electric discharge excited D_2/HCl gas dynamic laser has been performed. This model uses a Boltzmann transport code to model the electric discharge in pure D_2 or H_2 or in D_2 or H_2/rare gas mixtures. A one-dimensional stream tube code with finite vibrational kinetics and with a specified pressure distribution is used to calculate the cavity conditions of HCl vibrational populations and small signal gain. Instantaneous mixing of HCl is assumed in the nozzle region. This model is applied to a nominal experimental run for the NRL laser device. It is concluded that the discharge calculations are in close agreement with the available data, but that incomplete mixing of the HCl in the experiment precludes meaningful comparison of the cavity results. (NTIS)

14684 (AD/A-008164) SPECTROSCOPIC AND INFRARED MEASUREMENTS ON cw HF(DF) CHEMICAL LASERS. Kwok, M. A.; Giedt, R. R.; Cross, E. F. (Aerospace Corp., El Segundo, Calif. (USA)). 28 Feb 1975. Contract F04701-74-C-0075. 40p. NTIS $3.75.

The supersonic, free-jet medium of a 10 to 15 kW, HF/DF chemical laser is studied. Results from a remotely controlled spectrograph that scans rapidly, spatially, and spectrally are described; observations from an IR vidicon system are also given. The laser system includes two types of plenum gas heater: arc and combustor; and two types of nozzle bank: split and axisymmetric. The spectrograph measures the HF 3-0 p-branch emission, from which HF (3) number density along the line-of-sight N3L and rotational temperature T(R) are deduced at a large number of spatial positions. The data can be given as three types: (1) spatial scans transverse to the flow, (2) scans parallel to the flow, and (3) data at fixed position. Various interpretations concerning the medium result from the three types of data. (NTIS)

14685 (AD/A-008774) EXPERIMENTAL INVESTIGATION OF THE FLOW IN AN INTERSTAGE CONNECTING DUCT FOR USE ON A HIGH POWER GASDYNAMIC LASER. II. Mass Spectrometer and Pressure Measurements. Final Report. Golobic, R. A. (Frank J. Seiler Research Lab., U.S.A.F. Academy, Colo. (USA)). Mar 1975. 25p. NTIS $3.25.

A model of a duct used to optically connect high-power gasdynamic lasers was tested employing the USAF Academy trisonic wind tunnel. The wind tunnel was used as the cold flow simulation of the laser operating at a Mach number of 4.38 and test section static pressures of 0.5 to 0.8 psia and a mock-up of one half of the laser duct was attached to the wind tunnel test section. Mass spectrometer analysis of the flow composition at two locations resulted in the determination of the power mass flow rate out of the duct necessary to keep it free of wind tunnel gas. Helium, nitrogen and argon were tested as purge gases. The similarity parameter used to relate the wind tunnel tests to the actual laser conditions was found to be dependent upon the type of purge gas. Shear-layer stability is thought to account for this discrepancy. Pressure measurements revealed no sharp disturbances during purging. (auth)

14686 (JPRS-57906) FORMATION OF AN INVERSION IN CO_2-H_2O-N_2 GAS MIXTURE JET EXPANDING THROUGH A SLIT. Kudryavtsev, E. M.; Faizulaev, V. N. 4 Jan 1973. Translation of Russian Preprint No. 68. 17p. NTIS $3.00.

A study on the relaxation kinetics calculated for a CO_2-H_2O-N_2 mixture with consideration of the gas dynamics of escape from a slit-nozzle with an angle of opening of 60° is described. (auth)

14687 (JPRS-61199) DESIGN OF GAS-DYNAMIC-CO_2 LASER. I. Amplification Factor. Krasitaskaya, L. S.; Napartovich, A. P.; Sharkov, V. F. Translated from Teplofiz. Vys. Temp.; 11: No. 6, 1155-1161(1973). NTIS $3.00.

The problem of determining the amplification factor of a CO_2 GDL is discussed. Results of calculations are presented in graphical form. (NTIS)

14688 (MATSCIENCE-77) PROCEEDINGS OF THE CONFERENCE ON FOURIER OPTICS, LASERS, AND HOLOGRAPHY, MYSORE, INDIA, NOVEMBER 11-15, 1971. Ramakrishnan, A. (ed.). (Institute of Mathematical Sciences, Madras (India)). 1971. 159p. (CONF-711162-).

A separate abstract was prepared for one of the twelve papers presented at the conference. The remaining eleven papers were not in the subject scope of NSA. (TFD)

For an abstract of an individual paper see: 14689.

14689 (MATSCIENCE-77, pp 16-25) DEVELOPMENT OF NEW HIGH-FREQUENCY LASERS: X-RAYS. Jha, S. S. (Tata Inst. of Fundamental Research, Bombay). 1971.

From conference on Fourier optics, lasers and holography; Mysore, India (11 Nov 1971).

In proceedings of the conference on Fourier optics, lasers, and holography.

The various possibilities which can shift the higher frequency limit of the available lasers towards the extreme ultraviolet and x-ray region are examined. (TFD)

14690 (N-71-21843) MOLECULAR ENERGY TRANSFER BY FLUID MIXING. Progress Report, 1 January 1968-1 January 1971. Cool, T. A. (Cornell Univ., Ithaca, N. Y. (USA)). 4 Feb 1971. Contract NGI-33-010-064. 23p. (NASA-CR-117503). NTIS $3.00.

Highlights are discussed of a program on the use of rapid mixing techniques and high speed flows for laser power enhancement. Three tasks are reviewed: (1) continuous wave chemical laser development, (2) N_2-CO_2 electrically excited fluid mixing laser techniques, and (3) gas dynamic mixing behind shock waves. Purely chemical HF and DF laser operation is also discussed. (NTIS)

14691 (N-72-10432) DIATOMIC INFRARED GAS-DYNAMIC LASER. McKenzie, R. L. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center). 26 Apr 1971. 14 p. NTIS $3.00.

A laser is provided which utilizes the infrared vibration rotation transitions of a diatomic gas such as carbon monoxide. The laser action is produced by an active diatomic gas such as carbon monoxide mixed with a vibrationally resonant pumping gas such as nitrogen. In addition, a noble gas such as argon may be employed as a third gas in the mixture. The gas mixture contains from 1 to 80 vol percent of the active gas based on the pumping gas, and the third gas, if used, can constitute up to 90 percent of the total gas volume. A number of significantly different wavelengths can be produced by the laser. A single laser may contain several optical resonators at different locations, so that the desired wave length can be selected at will. (NTIS)

14692 (N-72-19570) RESEARCH AND INVESTIGATION OF GAS-DYNAMIC LASERS. Final Report. Boedeker, L. R.; Bronfin, B. R. (United Aircraft Corp., East Hartford, Conn. (USA)). 10 Nov 1971. Contract NASw-2181. 66p. (NASA-CR-125806). NTIS $3.00.

Chemical mixing laser investigations were conducted (1) to investigate the properties of a bimolecular exchange laser system pumped by the H + Cl_2 yields HCl(v) + Cl reaction, initiated by arc-dissociated H_2, with lasing occurring between wavelengths of 3.4 and 4.0 mu, and (2) to establish the feasibility of an atom recombination-transfer laser employing recombination of arc-dissociated nitrogen with subsequent transfer of vibrational energy to CO_2 for lasing at 10.6 mu. One-dimensional analytical results indicate higher results should be obtained with up to v equals 3 to 2 transitions participating. Diagnostic and analytical results show that the reaction mechanism during mixing, a back reaction of HCl(v) with H atoms, reaction of Cl with H_2(v), moderately fast V-V, V-T processes, and possible HCl(c) initial contaminant level may explain the low performance. N_2-CO_2 thermal mixing laser studies were extended to measure the efficiency of transfer of recombination energy in such a nonequilibrium N_2 source to 10.6 mu optical energy. The low level of efficiency suggests that V-T atom recombination-transfer laser decay processes may prevent vibrational energy freezing until much lower temperatures are achieved and that trapping of energy in long-lived electronic excitation of N_2 may be a factor. (auth)

14693 (N-72-25488) RESEARCH AND INVESTIGATION OF GAS-DYNAMIC LASERS. Final Report, 10 February-10 October 1971. Boedeker, L. R.; Bronfin, B. R. (United Aircraft Corp., East Hartford, Conn. (USA)). 10 Nov 1971. Contract NASw-2181. 64p. (NASA-CR-126718). NTIS $5.25.

Chemical mixing laser investigations were conducted (1) to investigate the properties of a bimolecular exchange laser system pumped by the H + Cl_2 yields HCl(v) + Cl reaction, initiated by arc dissociated H_2, with lasing occurring between lambda equals 3.4 and 4.0 mu, and (2) to establish the feasibility of an atom recombination transfer laser employing recombination of arc dissociated nitrogen with subsequent transfer of vibrational energy to CO_2 for lasing at 10.6 mu. Diagnostic and analytical results showed that the reaction mechanism during mixing, a back reaction of HCl(v) with H atoms, reaction of Cl with H_2(v), moderately fast V-V, V-T processes, and possible HCl(o) initial contaminant level, are among the key features which may explain the low level of performance. Atom recombination transfer experiments employed quenching of arc-dissociated N_2 in a plenum wherein transit of recombined N_2 is fast relative to N_2 vibrational decay at the quenched temperature. Nitrogen-CO_2 thermal mixing laser studies were extended to measure the efficiency of transfer of recombination energy in a nonequilibrium N_2 source to 10.6 mu optical energy. (auth)

14694 (N-73-17607) APPLICATION OF MOLECULAR LASER TO THE STUDY OF EXCITED STATES POPULATIONS IN AN EXPANDING MIXTURE. Thomas-Andraud, M. (Office National d'Etudes et de Recherches Aerospatiales (ONERA), Paris (France)). Sep 1972. 66p. (In French). (ONERA-NT-204). NTIS $5.50.

After a brief historical survey of the work done in France and abroad on molecular lasers, the principle of high pressure thermal laser is described, i.e., a pre-heated and compressed N_2-CO_2 mixture is quickly expanded in a supersonic nozzle, so as to obtain a population inversion of the CO_2 (001) and CO_2 (100) levels. The vibrational model chosen and the relaxation equations retained to represent the various energy exchanges taking place during expansion are discussed. A computer program was written in order to predict the results; the so-called time integration unsteady method used for expressing the evolution of the various flow parameters is briefly presented. Lastly, after describing the facility used and mentioning the advantages of its compression heater, the experimental results obtained are given. (auth)

14695 (NTIS/PS-75/016) CARBON MONOXIDE LASERS (A BIBLIOGRAPHY WITH ABSTRACTS). Werner, K. G. (National Technical Information Service, Springfield, Va. (USA)). Jan 1975. 88p. NTIS $25.00.

The bibliography contains 83 selected abstracts of research reports retrieved using the NTIS on-line search system—NTISearch. References cover discharge, gas dynamic, electron beam, and chemical lasers involving carbon monoxide as a lasing medium. Molecular excitation, energy transfer, and relaxation kinetics occurring in carbon monoxide lasers are also included. (NTIS)

14696 (NTIS/PS-75/573) GAS DYNAMIC LASERS. A Bibliography with Abstracts. Search period Covered: 1964-June 1975. Werner, K. G. (National Technical Information Service, Springfield, Va. (USA)). 1975. 169p.

Research citations covering 112 kinetic and energy transfer processes, design, and performance of gas and chemical lasers relying on gas dynamic effects for lasing enhancement are presented. Diffusion and flow studies specifically applicable to such lasers are also included. (NTIS)

14697 (SAND-75-5798) ELECTRON-BEAM EXCITATION OF GAS LASERS. Gerardo, J. B.; Ramirez, J. J.; Gerber, R. A.; Patterson, E. L.; Prestwich, K. R. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1975. 30p. (CONF-751108-15). Dep. NTIS $5.00.

From 1st international topical conference on electron beam research and technology; Albuquerque, New Mexico, USA (3 Nov 1975).

Gas-laser-excitation with intense relativistic electron beams has gained popularity through many successful demonstrations of efficient conversion of electron-beam energy to laser energy. In some instances, electron-beam excitation of gas lasers has resulted in record laser energy and/or power, in higher efficiencies than has ever been obtained with any other excitation scheme, and in the discovery of lasers that have not been produced by any

other excitation schemes. The feature of electron beams that make this laser excitation scheme so promising for use in high-power lasers is the high-power capability of electron beams. Three electron-beam geometrical configurations have been applied to gas-laser-excitation; electron-beam coaxial with the laser axis, electron-beam perpendicular to the laser axis, and radial convergent electron-beams. Measurements and comparisons with theory for these three geometries are given. (auth)

14698 (UCID-16993) DYNAMICS OF TRIVALENT RARE EARTH MOLECULAR VAPOR LASERS. Krupke, W. F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 6 Jan 1976. Contract W-7405-Eng-48. 41p. Dep. NTIS $4.00.

Radiative transition probabilities in neodymium bearing vapors are reviewed and calculations are extended to visible laser transitions in terbium bearing vapor. Nonradiative relaxation processes in the pure and complexed halides are treated in greater detail. While precise, quantitative relaxation probabilities cannot be calculated on the basis of information presently available, plausibility arguments can be established which indicate the order of magnitude of relevant nonradiative decay probabilities. Reference to solid and liquid state nonradiative relaxation data for rare earth ions is reviewed to support the plausibility arguments for the vapor state. Having established the likelihood of high fluorescence yields in the vapor phase, various methods of laser pumping are discussed: optical pumping via parity allowed 4f-5d transitions; optical pumping via charge transfer bands of the vapor complex; and direct electron beam pumping. (TFD)

14699 OPTICALLY PUMPED LASER SYSTEMS. DeMaria, A. J.; Mack, M. E. (to United Technologies Corp.). US Patent 3,911,375. 7 Oct 1975. Filed date 21 Jun 1973. 10p.

Laser systems which are pumped by an electric discharge formed in a gas are disclosed. The discharge is in the form of a vortex stabilized electric arc which is triggered with an auxiliary energy source. At high enough repetition rates residual ionization between successive pulses contributes to the pulse stabilization. The arc and the gain medium are positioned inside an optical pumping cavity where light from the arc is coupled directly into the gain medium. (auth)

14700 GALLIUM ARSENIDE INJECTION LASERS. Thompson, G. H. B. (to International Standard Electric Corp.). US Patent 3,911,376. 7 Oct 1975. Priority date 15 Oct 1970, United Kingdom of Great Britain and Northern Ireland (UK). 4p.

The semiconductor injection laser includes a thin inner GaAs p-n junction layer between two outer GaAlAs layers which are backed by further thin outer GaAlAs layers with a heavier doping of AlAs. This reduces optical losses. Optical energy is further confined within the inner layers and the lasing threshold reduced by added outer GaAs layers of low electrical and thermal resistivity. (auth)

14701 LASER WITH TRANSVERSE MODE AND FREQUENCY SELECTION. Schmidt, W. (to Carl Zeiss Stiftung). US Patent 3,919,665. 11 Nov 1975. Priority date 12 Jul 1973, German, Federal Republic of (F. R. Germany). 4p.

A laser in which one of the two reflectors at the ends of the laser assembly is in the form of a roof prism, the other or second reflector being conventional is described. A Fabry-Perot etalon is arranged between the second reflector and the laser cell, the etalon being tiltable about an axis which is at either 45^0 to or parallel to an axial plane containing the apex line of the roof prism. An optically active plane parallel plate is located between the etalon and the laser cell, in one embodiment, or between the laser cell and the roof prism, in another embodiment. (auth)

14702 OPTICAL OSCILLATOR-AMPLIFIER LASER CONFIGURATION. McAllister, G. L. (to Northrop Corp.). US Patent 3,919,664. 11 Nov 1975. Filed date 27 Jun 1974. 4p.

A laser is described that has incorporated therein an oscillator formed by a pair of mirrors, at least one of the mirrors being positioned outside of the envelope. The mirrors are dimensioned and spaced from each other so that the resonator has a relatively low Fresnel number and is operated unstably. The entire surface of one of these mirrors is convex and diffracts a portion of the energy outside of the oscillator region. Also incorporated into the laser is an amplifier region defined by a separate pair of mirrors which receive the energy diffracted from the oscillator region. The second pair of mirrors form an optical system with a high Fresnel number. A filter, modulator or other control for the laser signal may be placed outside the laser envelope in the optical path of the oscillator. (auth)

14703 GAS DYNAMIC LASER DEVICE. Born, G. (to Messerschmitt-Bolkow-Blohm GmbH). US Patent 3,919,662. 11 Nov 1975. Priority date 29 Nov 1972, German, Federal Republic of (F. R. Germany). 6p.

The gas dynamic laser device is provided with an expansion chamber arranged between a heating chamber for the CO-gas and the resonance chamber. The expansion chamber is initially evacuated for producing a rarefaction wave. Between the heating chamber and the expansion chamber there are arranged rapid release means such as a valve or a diaphragm. Pressure recovering means are connected to the other side of the resonance chamber. (auth)

14704 METHOD AND APPARATUS FOR ALIGNING LASER REFLECTIVE SURFACES. Caruolo, A. B.; Davis, J. W.; Walch, A. P. (to United Technologies Corp.). US Patent 3,919,663. 11 Nov 1975. Filed date 23 May 1974. 8p.

Methods and apparatus used in the alignment of high power laser systems to obtain optimum performance are disclosed. An external source of visible radiation provides an alignment beam which is reflected along the axis of a resonator. Reflecting surfaces of the resonator are aligned with respect to the axis located by the visible beam. (auth)

14705 DIGITAL SCANNING, TUNABLE DYE LASER FOR SPECTROANALYTICAL METHODS. Harrington, D.; Malmstadt, H. V. (Univ. of Illinois, Chicago). Am. Lab.; 6: No. 3, 33-38, 40(Mar 1974).

An easily constructed and relatively low cost digital scanning tunable dye laser was designed and constructed. The laser was obtained from a commercial programmable monochromator modified with dye cell and mirror attachments. It is pumped by a nitrogen laser and operated in the spectral range 358 to 641 nm, using eight dyes. Pulse duration is less than 10 nsec, and pulse repetition rate is 0 to 20 pulses/sec continuously or up to 100 pulses/sec in short bursts. (Electr. Electron. Abstr.)

14706 POLARIZED CONTINUOUS WAVE CRYSTALLINE LASER. Young, D. S. (to Sanders Associates, Inc.). US Patent 3,914,710. 21 Oct 1975. Filed date 6 May 1974. 4p.

A beam splitting polarizer is positioned in a laser cavity consisting of a laser rod and two highly reflecting mirrors. The laser rod is continually pumped, producing thermally induced stress birefringence in the laser rod, which performs a polarization rotation which is used to couple energy via the polarizer from inside the laser cavity. The stress pattern in the laser rod can be changed by rotation of the plane containing the pumping lamp and laser rod axes while keeping the beam splitter polarizer stationary. Two cavity configurations are shown, one in which the HR mirrors are arranged in opposed facing relationship, and the other with the mirrors being arranged orthogonally with respect to each other, and the beam splitting polarizer which is utilized for obtaining the polarization component with the largest gain. The gain of each of these configurations can be controlled by the aforesaid rotation of the pump lamp and laser rod with respect to the beam splitting polarizer. (auth)

14707 ASYMMETRICALLY EXCITED SEMICONDUCTOR INJECTION LASER. Ladany, I.; Marinelli, D. P.; Kressel, H.; Cannuli, V. M. (to RCA Corp.). US Patent 3,916,339. 28 Oct 1975. Filed date 25 Nov 1974. 4p.

A diode laser is improved in order to produce an output in a single longitudinal mode. The laser has a rectangular body with two regions of differing conductivity type material. Extending from one surface of the rectangular body and into one of the regions of differing conductivity material is a third region. Although the third region is composed of the same general conductivity type material as the region into which it extends, it is more highly doped with conductivity modifiers (more conductive). This third region extends along one surface between the ends of the body and is spaced from the sides of the body. An electrical contact stripe is positioned on the one surface so that a portion of its width overlaps a portion of the width of the third region. (auth)

14708 METAL ATOM OXIDATION LASER. Jensen, R. J.; Rice, W. W.; Beattie, W. H. (to Energy Research and Development Administration). US Patent 3,916,338. 28 Oct 1975. Filed date 13 May 1974. 8p.

A chemical laser which operates by formation of metal or carbon atoms and reaction of such atoms with a gaseous oxidizer in an optical resonant cavity is described. The lasing species are diatomic or polyatomic in nature and are readily produced by exchange or other abstraction reactions between the metal or carbon atoms and the oxidizer. The lasing molecules may be metal or carbon monohalides or monoxides. (auth)

14709 DISCHARGE CONTAINER STRUCTURE FOR A GAS LASER. Kindl, H.; Westermeier, H. (to Siemens Aktiengesellschaft). US Patent 3,916,337. 28 Oct 1975. Priority date 30 Jul 1973, German, Federal Republic of (F. R. Germany). 6p.

In a discharge structure for a gas laser having electrodes for the production of a gas discharge, wherein on a section of the discharge container of insulating material, a resistance layer is applied which forms a current-limiting resistor, and in which the

section carrying the resistance layer is an arbitrary short-circuit and breakdown-proof wall portion of the discharge container. (auth)

14710 GAS DISCHARGE LASER AND METHOD OF MANUFACTURING SAME. Haans, P. F. A. (to Philips Corp.). US Patent 3,913,032. 14 Oct 1975. Priority date 21 Jul 1972, Netherlands. 4p.

On a thick-walled capillary tube rounded edges are pressed at either end. Double-conical surfaces are ground on the rounded edges so that a fitting edge which is very obtuse in cross-section is obtained for laser mirrors of a He-Ne laser of an economic construction. (auth)

14711 CW ORGANIC DYE LASER. Tuccio, S. A.; Peterson, O. G. (to Eastman Kodak Co.). US Patent 3,913,033. 14 Oct 1975. Filed date 1 Jul 1974. 18p.

A method and apparatus for producing continuous emission from a lasing medium comprising organic dye molecules in solution are described. Continuous emission is accomplished by flowing the medium through a focused optical cavity while simultaneously producing a population inversion in that portion of the medium flowing in close proximity to the focal point of the cavity. The population inversion is produced by pumping the medium longitudinally, along the optical axis of the cavity, preferably by the focused output of a continuous-wave argon laser. Sufficient thermal energy is continuously dissipated from the medium to maintain the optical homogeneity thereof at or above the quality required for continuous emission. (auth)

14712 APPARATUS FOR LENGTHENING LASER OUTPUT PULSE DURATION. Pike, C. T.; Itzken, I. (to Jersey Nuclear-Avco Isotopes, Inc.). US Patent 3,914,709. 21 Oct 1975. Filed date 14 May 1973. 8p.

An apparatus for use with a laser oscillator having a short duration pulse output with high spectral purity for amplifying and lengthening the pulse output without loss of spectral purity is described. The apparatus typically includes a laser amplifier and means for applying radiation from the laser oscillator to the amplifier and for reapplying a predetermined portion of the amplifier output regeneratively to the amplifier to maintain it in an amplifying condition for a period several times longer than the duration of the original radiation pulse from the laser oscillator. A timing system is provided for synchronizing the application of laser oscillator radiation to the amplifier coincident with excitation of the amplifier to a lasing condition. (auth)

14713 SIMPLE LOW COST NITROGEN LASER. Cojocaru, E.; Udrea, M. (Inst. of Atomic Physics, Bucharest). Rev. Roum. Phys.; 20: No. 5, 459-462(1975).

The achievement of an efficient powerful N_2 laser is reported. A parabolic flat line is used. 1 MW peak power, 10 ns pulse length, 100 Hz rate of repetition, 1% efficiency are the performances obtained. (auth)

14714 DIRECTLY HEATED THERMOIONIC CATHODE FOR USE IN IONIC LASERS WITH NOBLE GASES. Gutu, I.; Ivanov, I. (Inst. of Atomic Physics, Bucharest). Rev. Roum. Phys.; 20: No. 4, 429-431(1975).

A thermoionic cathode for use in ionic lasers with noble gases is presented. The cathode was successfully operated in argon and krypton ion lasers. (auth)

14715 CONSTRUCTION AND OPERATION OF AN ARGON (KRYPTON) ION LASER. Gutu, I.; Ivanov, I.; Medianu, R.; Georgescu, C. (Inst. of Atomic Physics, Bucharest). Rev. Roum. Phys.; 20: No. 4, 351-356(1975).

Argon (krypton) laser experiments were performed in a segmented graphite plasma tube. The plasma tube operates either in the "open-flow" or "close-mode." Technological details of several laser components are shown. The efficiency of the internal gas recirculation, the effect of the magnetic field intensity, discharge current and mirror transmittance on output power were investigated. The photographs of the optical radiation mode pattern for different discharge currents and coupling mirror transmittances are also presented. (auth)

14716 GENERATION OF ORGANIC DYES IN THE 339 TO 640 nm REGION DURING EXCITATION BY THE PLASMA FOCUS OF A MAGNETOPLASMA COMPRESSOR. Kozlov, N. P.; Protasov, Yu. S. (Moscow Higher Technical School). Dokl. Akad. Nauk SSSR; 223: No. 1, 80-82(1 Jul 1975). (In Russian).

A gas discharge plasma can be efficiently used in organic dye laser pumping. This source has a high intensity in the interval of photon energies creating an inversion population in the laser with a small energy loss to the surroundings. In selecting the temperature and density of the plasma the best conditions are realized in the plasma focus of a magnetoplasma compressor. Excitation of organic dye solutions was carried out at threshold energies of ~1 to 3 kJ. The discharge parameters were: C_o = 150 to 756 microfarals; U_o = 3 to 5 kv; I_{max} ~70 to 220 kV; τ = 1.2 to 22 μs; $n_e = 7 \times 10^{17}$ to 5×10^{18} cm^{-3}; T_e = 2.5 to 4 eV. Excitation experiments were carried out on solution of rhodamine 6 zh, 1,4-di-2-(5-phenyloxazolyl)-benzene (POPOP)' and paraterphenyl. Large photon fluxes and high conversions were noted. The rhodamine 6 zh laser showed a generation power of 7.5 MW at a pumping energy of 2700 J with a conversion efficiency of 0.24% and a wavelength generation of 595 nm at the center of a dye concentration of 7×10^{-4} moles/l. These parameters can be increased by increasing the discharge energy. (SJR)

14717 REPORT ON THE SYMPOSIUM "LASERS AND CHEMICAL REACTIONS." Wolfrum, J. Nachr. Akad. Wissensch. Goettingen.; No. 5, 103-113(1973). (In German)

From symposium on lasers and chemical reactions; Reinhausen, F. R. Germany (25 Feb 1973). 4 figs.; 12 refs.

This first European symposium on "lasers and chemical reactions" reflects the vivid development of this field. From the variety of reports, this paper selects some significant examples of new developments, e.g., in the fields of dye lasers, selective photolysis (hydrogen isotope separation by means of formaldehyde/formaldehyde-D_2), gas and molecular lasers and their use for the direct influencing of chemical reactions. (DE)

14718 STAGE OF DEVELOPMENT AND OPERATIONAL POSSIBILITIES OF LASERS. Mioduszewski, P. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Plasmaphysik). Chem.-Ing.-Tech.; 47: No. 16, 670-677(Aug 1975). (In German)

5 figs.; 1 tab.; 77 refs.

In the first part of the article, a survey of the state of development of lasers is given. The compilation of the single type of laser is given according to the aspects of the following aims: high continuous-wave power, high pulse power, extension of the wavelength region and gradation of the wavelength. In the second part of the article, the possible applications of lasers in research and technology are discussed. (DE)

14719 QUENCHING OF THE LASER GENERATION OBTAINED FROM RHODAMINE B ETHANOL SOLUTIONS USING PULSE FLASH-LAMP EXCITATION. Stefanov, V. J.; Todorovska, R. V.; Kaprielo, B. K. (Inst. of Electronics, Sofia). Bulg. J. Phys.; 2: No. 3, 267-273(1975). (In Russian)

The decrease in the efficiency and the loss of laser generation from rhodamine B ethanol solutions were studied. It is shown that the main reason for the decrease in output energy and generation quenching during multiple illumination of the solution is the increase in the initial-loss coefficient, caused by an increase in the inactive absorption within the generation frequency band due to irreversible changes in the solvent. The photo-dissociation of ethanol is proved to take place under the existing experimental conditions. Complementary broadening of the generation frequency spectrum is detected and it is due to changes in acidity of the medium. (auth)

14720 TIME-RESOLVED OUTPUT SPECTRUM FROM A HYDROGEN FLUORIDE LASER USING MIXTURES OF SF_6 AND HI. Greiner, N. R. (Los Alamos Scientific Lab., NM). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE11: No. 10, 844-845(Oct 1975).

The time-resolved spectrum from a transverse-discharge hydrogen fluoride (HF) laser using a mixture of SF_6 and HI is reported. Because this spectrum matches that from a high-pressure H_2-F_2 laser, and because the SF_6-HI mixture is chemically stable, this laser should be a suitable and convenient source for probing H_2-F_2 amplifiers. (auth)

14721 CONVERSION EFFICIENCY AND PULSE SHORTENING OF A FREQUENCY-TRIPLED, SUB-NANOSECOND, 1.064 mu m PULSE. Attwood, D. T.; Pierce, E. L.; Coleman, L. W. (Univ. of California, Livermore). Opt. Commun.; 15: No. 1, 10-12(Sep 1975).

Single pulses from a mode-locked Nd laser are frequency tripled in a cascade process to provide a 3547 A probe for holographic interferometry of laser-produced plasmas. Overall energy conversion in excess of 30 percent and directly measured pulse shortening of 24 percent are reported for KDP crystals with an incident intensity of 10^9 W/cm^2. (auth)

14722 HF CHEMICAL LASERS. Jensen, R. J. (Los Alamos Scientific Lab., NM). pp 53-70 of Progress in Lasers and Laser Fusion. Perlmutter, A. (ed.). New York; Plenum Press (1975).

From Orbis scientist meeting; Coral Gables, Florida, USA (21 Jan 1975). See CONF-750110-P2.

The design, operation, and suitability of HF lasers for driving compression fusion reactions are reviewed. (TFD)

14723 THREE QUASI-cw APPROACHES TO SHORT WAVELENGTH LASERS. Elton, R. C. (Naval Research Lab., Washington, DC). pp 117-145 of Progress in Lasers and Laser Fusion. Perlmutter, A. (ed.). New York; Plenum Press (1975).

From Orbis scientist meeting; Coral Gables, Florida, USA (21 Jan 1975). See CONF-750110-P2.

Three approaches towards achieving extended-period quasi-cw amplification by stimulated emission in the vacuum-uv and x-ray spectral regions are discussed, in a somewhat logical progression towards shorter wavelengths, increased complexity, and demands. Extrapolation of visible and near-uv tuned-cavity cw lasers using higher density plasma media is first discussed for the near-to-mid vuv region. Further extension to the soft x-ray region is described, using preferential resonance charge transfer pumping. This and related intense incoherent x-ray source development could ultimately lead to successful quasi-cw Kalpha inversions, as is discussed. Experiments underway to test the first two schemes are described. (auth)

14724 REVIEW OF SOFT X-RAY LASERS USING CHARGE EXCHANGE. Cantrell, C. D. (Los Alamos Scientific Lab., NM); Scully, M. O.; Boyer, K. pp 147-234 of Progress in Lasers and Laser Fusion. Perlmutter, A. (ed.). New York; Plenum Press (1975).

From Orbis scientist meeting; Coral Gables, Florida, USA (21 Jan 1975). See CONF-750110-P2.

Charge exchange vacuum ultraviolet and soft x-ray lasers using ion beams are reviewed. The basic idea of the reaction is that one avoids the rapid Auger rates characteristic of many other x-ray laser schemes by picking up an electron in the outer shell of a hydrogen-like, helium-like, or lithium-like ion. (TFD)

14725 SOFT X-RAY LASERS VIA ELECTRON-COLLISIONAL PUMPING. Andrews, R. A. (Naval Research Lab., Washington DC). pp 235-268 of Progress in Lasers and Laser Fusion. Perlmutter, A. (ed.). New York; Plenum Press (1975).

From Orbis scientist meeting; Coral Gables, Florida, USA (21 Jan 1975). See CONF-750110-P2.

The feasibility and problems associated with obtaining gain in the soft x-ray region of the spectrum by using electron collisional pumping of an appropriate ion species are discussed. (TFD)

14726 X-RAY AND GAMMA-RAY LASERS. Chapline, G.; Wood, L. (Lawrence Livermore Lab., CA). pp 269-280 of Progress in Lasers and Laser Fusion. Perlmutter, A. (ed.). New York; Plenum Press (1975).

From Orbis scientist meeting; Coral Gables, Florida, USA (21 Jan 1975). See CONF-750110-P2.

The possibilities of producing coherent radiation at wavelengths lambda less than 10 A are discussed. (TFD)

14727 HIGH-PRESSURE ELECTRIC-DISCHARGE CO_2 LASER. Ishchenko, V.N.; Lisitsyn, V.N.; Safonov, V.P.; Sorokin, A.R. (Institute of Semiconductor Physics, Siberian Branch, Academy of Sciences of the USSR, Novosibirsk). Sov. J. Quantum Electron. 5: No. 7, 738-741 (July 1975).

An investigation was made of an electric-discharge CO_2 laser with a volume preionization by an auxiliary discharge through a dielectric. A low-resistance circuit was used to supply the main discharge. Stimulated emission was observed at pressures up to 13 atm in the mixture. The spectral composition of the output radiation and the nature of its pulsations were investigated as a function of the pressure and composition of the mixture. Consideration was given to the possibility of constructing continuously tunable and high-power lasers on the basis of the method described. (auth)

14728 PULSE STIMULATED EMISSION FROM BERYLLIUM VAPOR. Zhukov, V.V.; Il'yushko, V.G.; Latush, E.L.; Sém, M.F. (Rostov-on-Don State University). Sov. J. Quantum Electron. 5: No. 7, 757-760 (July 1975).

It was demonstrated that stimulated emission was possible as the result of several transitions in the spectrum of Be II. An experimental study was made of the stimulated emission due to the following ionic transitions in beryliium: $4F$-$3D$ at λ=467.5 nm, $4S$-$3P$ at λ=527.2 nm, and $3P$-$3S$ at λ=1209.6 nm, all which occurred during the afterglow stage of a pulse discharge. It was established that the laser levels were pumped by charge exchange between helium or neon ions and beryllium atoms, and also due to recombination of doubly charged beryllium ions. It was found that the population inversion and the characteristics of stimulated emission were influenced strongly by inelastic collisions with slow electrons. (auth)

14729 SELECTION OF OPTIMAL PUMP POWER FOR A CO_2 LASER WITH A NON-SELF-SUSTAINED DISCHARGE. Dubovoi, L.V.; Zaitsev, V.A.; Poponin, V.P.; Shanskii, V.F. (D. V. Efremov Scientific-Research Institute of Electrophysical Apparatus, Leningrad). Sov. J. Quantum Electron. 5: No. 7, 760-762 (July 1975).

A numerical analysis is made of a kinetic model of the processes occurring in a pulse CO_2 laser excited by a non-self-sustained discharge. It is shown that the results of calculations are in satisfactory agreement with the experimental data in the range of pump powers covering long- and short-pulse regimes. The proposed model is used in the optimization of the parameters of this laser at atmospheric pressure in the specific pump power range $1–10^3$ kW/cm^3. It is found that the optimal specific power, which produces the highest specific output energy in a pulse Q_{out}, corresponds to high He concentrations in the gas mixture. The maximum value of Q_{out}(0.12 J cm^{-3} atm^{-1} for an efficiency up to 25 %) is achieved at pump powers corresponding to discharge electron densities in the range $(1–5)\times10^{13}$ cm^{-3} and for pump pulse durations 5–10 μsec. (auth)

14730 THEORETICAL INVESTIGATION OF THE VIBRATIONAL RELAXATION OF CO_2 IN MIXTURES CONTAINING CARBON MONOXIDE. D'yakov, A.S.; Piskunov, A.K.; Cherkasov, E.M. (Moscow Physicotechnical Institute). Sov. J. Quantum Electron. 5: No. 7, 762-764 (July 1975).

A theoretical analysis is made of the vibrational relaxation in a nonequilibrium stream in a gasdynamic laser utilizing $CO+N_2+CO_2+H_2O$ mixtures. The dependence of the population inversion for the $00^01–10^00$ transition in the CO_2 molecule on the concentration of CO is obtained. It is shown that under certain conditions it should be possible to construct a gasdynamic laser utilizing CO_2 transitions in nitrogen-free mixtures. (auth)

14731 GASDYNAMIC LASERS WITH AUXILIARY OPTICAL PUMPING. Shmelev, V.M.; Margolin, A.D. (Institute of Chemical Physics, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 7, 776-778 (July 1975).

Preliminary ideas are developed on the use of auxiliary optical pumping in a gasdynamic laser. The auxiliary pump source may be a second laser or the gasdynamic laser itself with a feedback in its optical channel. Such additional optical pumping may increase the gain of the medium and it may also allow reduction in the expansion ratio of a gas passing through a nozzle in a gasdynamic laser. (auth)

14732 MULTIFACTOR OPTIMIZATION OF A CARBON DIOXIDE GASDYNAMIC LASER. I. GAIN OPTIMIZATION. Losev, S.A.; Makarov, V.N. (Institute of Mechanics of M. V. Lomonosov State University, Moscow). Sov. J. Quantum Electron. 5: No. 7, 780-783 (July 1975).

The variational problem of the optimal operating conditions in the gasdynamic carbon dioxide laser is solved in such a way as to maximize the gain for the P20(001) → (100) transition in the case of nozzles of arbitrary shape. A comparison is made with the results of optimization obtained for planar wedge-shaped nozzles. The optimal initial conditions (temperature, pressure, and composition) are found and the optimal nozzle shape is obtained for mixtures of carbon dioxide with nitrogen and helium. A continuous increase in the gain with rising pressure is predicted for optimal operation of the gasdynamic laser. (auth)

14733 LONGITUDINAL MODE SELECTION IN A RESONATOR WITH A PERIODIC PERMITTIVITY DISTRIBUTION. Bogdankevich, O.V.; Borisov, N.A.; Bryunetkin, B.A.; Darznek, S.A.; Lavrushin, B.M. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Leningrad). Sov. J. Quantum Electron. 5: No. 7, 783-786 (July 1975).

A solution is given to the electrodynamic problem of the spectrum and threshold of modes in a multilayer resonator in which the permittivity along the resonator axis is a piecewise-linear periodic function of the coordinate. This resonator is proposed for stable single-mode emission from semiconductor lasers. (auth)

14734 GASDYNAMIC PHOTORECOMBINATION LASERS. Kochelap, V.A.; Kukibnyi, Yu.A. (Institute of Semiconductors, Academy of Sciences of the Ukrainian SSR, Kiev). Sov. J. Quantum Electron. 5: No. 7, 790-796 (July 1975).

A quantitative analysis is made of several features of gasdynamic photorecombination lasers utilizing electronic transitions. The flow of a recombining gas through a supersonic nozzle is calculated in the sudden freezing approximation. Nonequilibrium dissociation, population inversion criteria, and the energy stored in inverted states are all considered. The dependences of these quantities on the initial conditions, nozzle shape, etc. are analyzed. (auth)

14735 INFLUENCE OF GAIN SATURATION ON THE FREQUENCY PULLING OF THE STIMULATED EMISSION FROM LINEAR RING He–Ne LASERS. Privalov, V.E.; Filatov, Yu.V. (D. I. Mendeleev All-Union Scientific-Research Institute of Metrology, Leningrad). Sov. J. Quantum Electron. 5: No. 7, 800-805 (July 1975).

An investigation was made of the dependences of the intermodal beat frequency of a linear laser and of the difference frequency of a ring laser on the gain of the active medium and the losses in the resonator. These dependences made it possible to determine the reduction in the frequency pulling with increasing output power, relative to the total pulling. A determination of this reduction made it possible to compare the results of experiments carried out under different conditions. A

comparison was made of the experimental results with the calculations. (auth)

14736 AMPLIFICATION IN A MIXTURE OF ISOTOPIC CO_2 MOLECULES PUMPED BY CO_2 LASER RADIATION. Golger, A.L.; Letokhov, V.S. (Institute of Spectroscopy, Academy of Sciences of the USSR, Akademgorodok, Moscow Province). Sov. J. Quantum Electron. 5: No. 7, 811-816 (July 1975).

A theoretical analysis is made of the possibility of constructing a continuously tunable gas laser emitting radiation as a result of resonant optical pumping of a mixture of isotopic molecules by the radiation of a second laser. It is shown that a simple sealed laser can be built on this basis. The gain is calculated for binary and ternary mixtures of isotopic CO_2 molecules subjected to optical pumping with $\lambda=9.6$ μ radiation emitted by a CO_2–N_2–He laser. It is shown that a gain of $\sim 2\times10^{-3}$ cm^{-1} should be obtained as a result of optical pumping of an isotopic mixture of CO_2 molecules at a pressure of 1 atm at 400°K and this should be true both under pulse and continuous emission conditions. In the pulse case, the pump energy density should be 10 J/cm^2. In the continuous case, the same gain can be obtained using waveguides resonators of ~ 100 μ diameter when the pump power is twice the threshold value of ~ 70 W. (auth)

14737 INVESTIGATION OF THE CONDITIONS GOVERNING THE STIMULATED EMISSION THRESHOLD OF A CF_3I (IODINE) LASER. Zaleskii, V.Yu.; Polikarpov, S.S. Sov. J. Quantum Electron. 5: No. 7, 826-832 (July 1975).

An analysis is made of the factors influencing the time t in which the stimulated emission threshold is reached in a CF_3I laser. The dependences of the time t on the resonator losses L and on the CF_3I vapor pressure, applicable to a laser pumped by rectangular pulses of relatively slow amplitude, are used to derive the pressure dependence of the laser line width. The absolute value of this width is determined experimentally at pressures sufficiently low for the broadening to be of the Doppler type. The results obtained are used to calculate the pumping rate and quantum efficiency of the laser. The value of the latter quantity (0.9 ± 0.18) demonstrates a high efficiency of recombination of the photodissociation products back into the original molecules. An experimentally verified approximation is used to develop a theory which yields the time dependence of the accumulation of metastable iodine atoms. The dependence $t'(L)$ in the nonlinear range of high values of L is used to find the combination $(k_1+k_2)/k_3^{1/2}$ of the rate constants of the reactions $I^*+CF_3 \xrightarrow{k_1} CF_3I$, $I^*+CF_3 \xrightarrow{k_2} I+CF_3$, $2CF_3 \xrightarrow{k_3} C_2F_6$, which govern this nonlinearity. The combination is found to be $1.0\pm0.35\times10^{-6}$ $cm^{3/2}\cdot sec^{-1/2}$. The results obtained indicate that the chemical pumping channels are ineffective in the case of CF_3I. (auth)

14738 TUNABLE DYE LASER WITH A NARROW EMISSION SPECTRUM. Novikov, M.A.; Tertyshnik, A.D. (Scientific-Research Radiophysics Institute, Gorkii). Sov. J. Quantum Electron. 5: No. 7, 848-849 (July 1975).

The use of a diffraction grating and a prism telescope in an organic dye laser improved considerably the selectivity and made it possible to operate at high energy levels. A polarization beam splitter was used in a longitudinal variant of pumping with laser radiation. The output frequency was continuously tunable in a wide range and the width of the spectrum was less than 0.1 cm^{-1}. (auth)

14739 CONTROL OF THE DIVERGENCE OF SUPERLUMINESCENCE EMITTED FROM LASERS. Ishchenko, V.N.; Lisitsyn, V.N.; Starinskii, V.N. (Institute of Semiconductor Physics, Siberian Branch, Academy of Sciences of the USSR, Novosibirsk). Sov. J. Quantum Electron. 5: No. 7, 851-853 (July 1975).

The example of an ultraviolet-emitting nitrogen laser was used in trying out two methods for reducing the divergence of superluminescent lasers: One involved introducing a periodic series of diaphragms in the discharge chamber and the other made use of a telescopic resonator. The characteristic features of these two methods were analyzed. (auth)

14740 WIDE-RANGE CONTINUOUS TUNING OF THE EMISSION FREQUENCY OF A HIGH-PRESSURE CO_2 LASER. Bagratashvili, V.N.; Knyazev, I.N.; Lobko, V.V. (Institute of Spectroscopy, Academy of Sciences of the USSR, Akademgorodok, Moscow Province). Sov. J. Quantum Electron. 5: No. 7, 857-859 (July 1975).

Continuous tuning of the emission frequency of a CO_2 laser operating at 5 atm was obtained for the P and R branches of laser transitions in a combined range of about 45 cm^{-1}. This was achieved for a maximum energy of 0.1 J per pulse and a spectral line width of 0.05 cm^{-1}. (auth)

14741 THIN-FILM RHODAMINE B LASER WITH A DISTRIBUTED FEEDBACK. Kolbin, I.I.; Ovcharenko, O.I.; Sotin, V.E.; Cheremiskin, I.V. (Patrice Lumumba Friendship of Nations University, Moscow). Sov. J. Quantum Electron. 5: No. 7, 860-861 (July 1975).

An investigation was made of stimulated emission from a thin-film rhodamine B laser with a distributed feedback. This feedback was produced by a periodic variation of the film thickness. The stimulated emission occurred at the wavelength of 6118 Å and the emission line width was less than 3 Å. (auth)

14742 LASER WITH CONTINUOUSLY TUNABLE EMISSION WAVELENGTH (λ=400–1000 nm). Bonch-Bruevich, A.M.; Razumova, T.K.; Starobogatov, I.O. Sov. J. Quantum Electron. 5: No. 7, 867-869 (July 1975).

A laser with a single-stage amplifier using organic dye solutions was found to emit radiation continuously tunable in the range 400–1000 nm. The width of the emission line was 0.1 nm, this could be reduced to 0.01 nm when a Fabry–Perot etalon was used. The stability of the emission wavelength from one flash to another was within 0.1 nm and the precision with which a given wavelength was selected was 0.15 nm. The fundamental frequencies and second-harmonics of ruby and neodymium lasers were used for pumping purposes. The properties of the output radiation were determined. (auth)

14743 HIGH-PRESSURE N^+_2 LASER EMITTING VIOLET RADIATION. Basov, N.G.; Vasil'ev, L.A.; Danilychev, V.A.; Dolgov-Savel'ev, G.G.; Dolgikh, V.A.; Kerimov, O.M.; Kozorovitskii, L.L.; Orlov, V.K.; Khodkevich, D.D. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 7, 869-870 (July 1975).

Stimulated emission at the $\lambda=427.8$ nm wavelength was obtained as a result of excitation of He+0.02–0.2 % N_2 mixtures by an electron beam ($W\simeq200$ keV, $I\simeq3$kA, $j\simeq50$ A/cm^2, $\tau\simeq50$ nsec). The upper laser level $N^+_2(B^2\Sigma^+_u)$ was populated by the transfer of energy from molecular helium ions. The observed stimulated violet radiation was due to the first negative band of the nitrogen ion ($B^2\Sigma^+_u, v'=0 \rightarrow X^2\Sigma^+_g, v''=1$). The energy characteristics of the laser were determined as a function of the composition of the mixtures at pressures of 0–7 atm. (auth)

14744 ANALYSIS OF LENSLIKE EFFECTS IN GAS LASERS. Rui-lin, Z. (Department of Physics, Nankai University). Chin. J. Phys. 23: No. 6, 274-279 (Nov 1974).

The optical cavities of general curved mirrors with a negative lenslike medium are discussed, and such cavities are used to anlayze the thermal lensing effects in gas lasers. The mode analysis is made for a cw CO_2 laser of a plane-concave cavity. It is shown that the thermal lensing effects have considerable influence on the output and resonant frequencies, particularly for the fundamental-mode lasers. Finally, possible thermal lensing effects in ion gas lasers and other lasers are briefly discussed. (auth)

14745 UV DYE LASERS. Abakumov, G. A.; Fadeev, V. V.; Khokhlov, R. V.; Simonov, A. P. (Moscow State Univ.). Spectrosc. Lett.; 8: No. 9, 651-667(1975).

The most important property of visible dye lasers, that is, continuous wavelength tuning, stimulated the search for dyes capable to lase in uv. They were found in 1968. Now the need for tunable uv lasers for applications in spectroscopy, photochemistry, isotope separation, remote air and sea probing, etc. is clearly seen. A review of some recent advances in uv dye lasers is reviewed. (auth)

14746 MAGNETOHYDRODYNAMIC GAS-DYNAMIC LASER. Cason, C. M. III. (to Office of the Secretary of the Army). US Patent 3,706,050. 12 Dec 1972. Filed date 2 Nov 1971. 8p.

The patent describes a pulsed gas laser which uses continuously expanding gases that pass through the lasing chamber and subsequently generate a direct current, pulsed electric output which is fed back to stimulate laser emission. A conventional gas burner and nozzle assembly couple flowing gases into a standard laser cavity. Gases leaving the laser cavity pass between poles of an MHD magnet, generating output electric power which is transformed into high voltage pulses of output power. An alkali metal component is introduced into the system before the flowing gases reach the MHD magnet for increasing electrical conductivity of the gas therein and thereby enhancing large pulses of electrical energy feedback for stimulating additional laser action. (NTIS)

14747 ISOTHERMAL GAS-DYNAMIC LASER NOZZLE. Neal, J. W. (to Department of the Air Force). US Patent Application 456,406. 29 Mar 1974. 14p.

The patent application describes a laser comprised of two identical hollow nozzle portions which are positioned in layered fashion (i.e., in stacked condition), in registration, and with their respective longitudinal axes in parallel. Each nozzle portion has a protrusion extending into the void or hollow interior, and coolant flow passages are located in the protrusion. The internal surface of each nozzle portion has a nickel fiber wick sintered to it, and the wick is saturated with a metal, preferably sodium, which is in a liquid state. The unique structure of the inventive nozzle permits a very short transient start and also permits operation of the nozzle at steady-state conditions in an isothermal manner. (NTIS)

14748 CHEMICAL LASER NOZZLE SYSTEM. Dobrzelecki, A.; Buggeln, R. C. (to Department of the Air Force). US Patent 3,842,363. 15 Oct 1974. Filed date 24 Oct 1972. 6p.

The patent discloses a novel laser nozzle system for use in any chemical laser in which a first gaseous reactant, a second gaseous reactant, and a diluent gas can be used. A preferred embodiment includes: a first nozzle which is dimensioned and is configurated to induce and to promote the supersonic flow of the first gaseous reactant through the first nozzle; a second nozzle which is positioned downstream both from the first nozzle and from the supersonic flow of the first gaseous reactant, and which is dimensioned and is configurated to continue the supersonic flow of the first gaseous reactant through the second nozzle; and, a plurality of hollow conduits which are disposed both in a transverse attitude to the second nozzle, and downstream of the second nozzle, with each conduit of the plurality having a first plurality of orifices. The nozzle system is readily adaptable to meet the varying parametric requirements of different chemical lasers such as HF. (NTIS)

14749 TUNABLE OPTICAL CAVITY FOR CHEMICAL LASER. Spencer, D. J.; Durran, D. A.; Bixler, H. A. (to Department of the Air Force). US Patent 3,731,221. 1 May 1973. Filed date 10 Aug 1971. 9p.

The patent describes a tunable optical cavity for use with a chemical laser of the type using a supersonic jet flow of a vibrationally excited gas as a lasing medium. It is characterized by having a variable optically active dimension running transverse to the longitudinal axis of its optically active region. (NTIS)

14750 SELF-PUMPED ELECTROADIABATIC LASER. Cason, C. M. III; Perkins, J. F. (to Office of the Secretary of the Army). US Patent 3,621,461. 16 Nov 1971. Filed date 9 Sep 1969. 5p.

The apparatus of the invention is an electroadiabatic gas laser in which pumping of the lasing medium is achieved by nozzle expansion of the gases and self-induced electron discharge therein. The gases are stimulated thermally to excited lasing states and adiabatically expanded into an excitation chamber where an electron discharge therein is enhanced. The adiabatic process produces a small part of the final stored laser energy and the self-generated electric field provides the greater energy gain by a direct stimulation from the electric discharge within the gas. Thus, the stored laser energy in the gas is stimulated by two separate sources within the laser. (NTIS)

Cryogenic and Superconducting Equipment and Devices

Refer also to abstracts 15262, 15398, 15400, 15701, 15890, and 15894.

14751 (COM-75-10472-03) SUPERCONDUCTING DEVICES AND MATERIALS. A Literature Survey Issued Quarterly, July–September 1975. (National Bureau of Standards, Boulder, Colo. (USA). Inst. for Basic Standards). 1975. 72p. National Bureau of Standards, Boulder, CO.

A brief summary of the quarter's highlights in the superconductivity field is presented. The summary is followed by an extensive bibliography. (TFD)

14752 (ERDA-tr-86, pp 58-73) CRYOGENICS ENGINEERING FOR LOW-TEMPERATURE PROJECTS OF THE INSTITUTE FOR EXPERIMENTAL NUCLEAR PHYSICS. Katheder, H.; Lehmann, W.; Spath, F. (Institute for Experimental Nuclear Physics, Karlsruhe, Ger.). Jan 1975. Translated from German report.

In reports of the Nuclear Research Center, Karlsruhe. 7th annual publication.

A discussion is given of the cryogenic engineering and installations required for superconducting devices used in particle accelerators. Closed He cooling circuits, with an integrated refrigerating plant and auxiliary equipment, were constructed for low temperature testing, and operational experience with the cooling systems is described. Also discussed are projects for a superconducting synchrotron at CERN and for resonant cavities and beam focusing magnets for the IEKP LINAC. (PMA)

14753 (ERDA-tr-92) PULSABLE SUPERCONDUCTING 28 kJ SOLENOID MAGNET. Juengst, K. P.; Obermaier, G. [nd]. Translation of German Report. 17p. Dep. NTIS $3.50.

The design, construction, and testing of a pulsable superconducting solenoid magnet ("PUSSY") are described. The magnet has a cold bore of 80 mm diameter, and it reached a central field of 4.75 T after little training in the first run. The field homogeneity is 0.1 percent in 30 mm dsv and 1 percent in 60 mm dsv. The peculiarities of this solenoid are the fully insulated braid conductor, consisting of 32 multifilament wires with 206 NbTi filaments each, and the application of copper heat sinks for the cooling of the magnet windings. The magnet reached a rate of field change of 2 T/s or 630 A/s without significant degradation with respect to dc operation. The magnet is to provide a homogeneous magnetic field in a large working volume to measure frequency-dependent losses in superconductors. (auth)

14754 (INR-1479/2/3/E/B) LIQUID NITROGEN CRYOSTAT WITH TEMPERATURE METER AND CONTROLLER FOR RADIATION DAMAGE. Burzynski, Z.; Leszczynski, M.; Rodek, J.; Werner, Z. (Institute of Nuclear Research, Warsaw (Poland)). 1973. 25p. (In Polish). INIS.

A liquid nitrogen cryostat with variable temperature tail is described. The sample temperature can be varied in the range from 80°K to 450°K. The cryostat cooperates with a temperature controller and is designed for radiation damage studies in semiconductors. A temperature meter and controller suitable for operation with liquid helium or liquid nitrogen cryostat was designed, and the thermocouples can be used as temperature sensors. The accuracy of the temperature measurement in the basic range (20°K above the reference temperature) is ±0.15°K and the accuracy of the stabilization is ±0.1°K. The reference voltage of the measurement and stabilization can be controlled and adjusted by means of the normal Weston element. The static characteristic of the instrument was determined and its dynamic properties are described. (auth)

14755 INDUCTION MOTOR FOR SUPERCONDUCTING SYNCHRONOUS/ASYNCHRONOUS MOTOR. Litz, D. C.; Haller, H. E. III. (to Secretary of the Navy). US Patent 3,916,229. 28 Oct 1975. Filed date 3 Jan 1975. 6p.

An induction motor structure for use on the outside of a superconducting rotor comprising a cylindrical shell of solid and laminated, magnetic iron with squirrel cage windings embedded in the outer circumference of said shell is described. The sections of the shell between the superconducting windings of the rotor are solid magnetic iron. The sections of the shell over the superconducting windings are made of laminations of magnetic iron. These laminations are parallel to the axis of the machine and are divided in halves with the laminations in each half oriented in diagonal opposition so that the intersection of the laminations forms a V. This structure presents a relatively high reluctance to leakage flux from the superconducting windings in the synchronous operating mode, while presenting a low reluctance path to the stator flux during asynchronous operation. (auth)

14756 STABILIZED SUPERCONDUCTORS. Wong, J. (to Supercon, Inc.). US Patent 3,910,802. 7 Oct 1975. Filed date 7 Feb 1974. 6p.

The stable, high field, high current composite wire comprises multiple filaments in a depleted bronze matrix, each filament comprising a type II superconducting, beta-tungsten structure, intermetallic compound layer jacketing and metallurgically bonded to a stabilizing copper core, directly or via an intermediate layer of refractory metal. (auth)

14757 SUPPORT STRUCTURE FOR A SUPERCONDUCTING MAGNET. Young, W. C.; Boom, R. W.; Peterson, H. A. (to Wisconsin Alumni Research Foundation). US Patent 3,919,677. 11 Nov 1975. Filed date 5 Jul 1974. 4p.

An electrical magnet having a support structure which comprises a flat plate of structural material and abutment means engaging the conductor of the electrical magnet to the plate is described. The abutment means may comprise a groove in a face of the plate which receives and restrains the conductor, a raised flange on a face of the plate which forms such a groove, or a flange which extends around and is affixed to the periphery of the plate and which is formed to fit tightly over a coiled conductor. When current is flowing in the conductor of the magnet, all points on the conductor will experience a magnetically induced force, one component of which is in an outward direction parallel to the plane of the plate. The abutment means opposes this component of the force and transmits it to the plate, which is consequently stressed in tension in two dimensions. Several individual magnets supported by the support structure may be combined to form large magnets having solenoidal, toroidal or other configurations. The magnets may be built with a normal or a superconducting electrical conductor. (auth)

14758 USE OF SUPERCONDUCTING SHIELDS FOR GENERATING ULTRA-LOW MAGNETIC FIELD REGIONS AND SEVERAL RELATED EXPERIMENTS. Cabrera, B. Stanford, CA; Stanford Univ. (1975). 212p. University Microfilms Order No. 75-21,850.

Thesis (Ph. D.).

Part I of this thesis describes a technique for producing ultra-low field regions. Lead foil (0.0025" thick and 99.9 percent pure) was used to construct cylindrical superconducting magnetic shields with bottom end caps (4" dia. x 33" long and 8" dia. x 56" long). Several shields with absolute fields below 10^{-3} gauss over 20" along their axes were fabricated. The shields are pleated, folded flat and then cooled through their transition temperature (7°K) by

"heat flushing," i.e., moving the transition temperature from bottom to top in a slow and controlled manner. Cooling a shield inside of an outer previously heat flushed one produced our lowest fields when repeated 2 to 4 times. The magnetic fields are measured using a Josephson double point contact magnetometer with a differential sensitivity of 10^{-9} gauss coupled to a flip coil for absolute calibration. Part II describes the investigation of residual trapped flux in small superconducting shields and of remanent magnetization in materials used in ultra-low field regions. The apparatus used for these measurements was placed inside an ultra-low field shield. Using this same apparatus the magnetic charge of a series of samples with a single-pass technique was also measured. Schwinger has suggested that the theoretical quarks of Gell-Mann's model may be magnetically charged. An experiment designed to measure the fractional electric charge of the proposed quarks have had some interesting results (further definitive experiments are now in progress). The magnetic charge of eleven samples was measured and found to be consistent with zero. The sensitivity was 1/50 g_0 (g_0 equals h-bar c/2e, the smallest magnetic charge allowed by the Dirac theory—although other theories predict larger values for the elementary magnetic charge). The results were consistent with those from similar multipass experiments conducted by Alvarez et al. (Diss. Abstr. Int., B)

14759 DETECTION OF HIGH FREQUENCY MICROWAVE PHONONS BY SUPERCONDUCTING TUNNEL AND JOSEPHSON JUNCTIONS. Tredwell, T. J. Rochester, NY; Univ. of Rochester (1975). 311p. University Microfilms Order No. 75-22,783.

Thesis (Ph. D.).

An experimental investigation of the interaction of high frequency microwave phonons with superconductors is described. Two different experiments were performed. In the first, Josephson junctions in the form of thin-film microbridges and thin-film point-contact junctions, were irradiated with 10 GHz microwave phonons. In the second, aluminum tunnel junctions were irradiated with gap frequency (70 GHz) microwave phonons. The experimental results of the first experiment fall into two categories. For very thin-film (500 A) Josephson junctions the interaction between sound wave and junction is coherent. The critical current was found to decrease with phonon power. This is explained by the coupling of the sound wave to the junction via the deformation potential of the aluminum film. In the second experiment, an aluminum tunnel junction was used to detect 70 GHz microwave phonons. The phonons was found to affect the junction through the breaking of Cooper pairs, giving rise to a new dynamic equilibrium in the super-conductor characterized by a reduced gap and an increased number of quasiparticles. Calculations of this new state were made on the basis of a model of an irradiated superconductor. (TFD)

14760 LOW-TEMPERATURE PHYSICS: BEYOND 273 DEGREES MINUS. Hasse, J. Bild Wiss.; 12: No. 7, 38-44(Jul 1975). (In German).

With figs.

A survey is given on various methods by which temperatures of no more than a few thousandth degrees above absolute zero are obtained. Furthermore, the He isotope ^{3}He is presented and discussed as the third superfluid system in addition to the superconductivity of metal electrons and the superfluidity of ^{4}He. (DE)

14761 HELIUM DILUTION REFRIGERATOR ^{3}He–^{4}He VERDUNNINGSKOELMACHINE. (to Philips Gloeilampenfabrieken N. V.). Netherlands Patent 7,315,487/A/. 13 Nov 1973. 10p. (In Dutch)

A new system of continuous heat exchange for a helium dilution refrigerator is proposed. The ^{3}He effluent tube is concurrent with the affluent mixed helium tube in a vertical downward direction. Heat exchange efficiency is enhanced by placing in series a number of elements with an enlarged surface area. (NL)

14762 ELECTRIC POWER AT LOW TEMPERATURES. Rechowicz, M. Oxford; Clarendon Press (1975). 149p.

The application of low temperatures to power engineering systems is described with particular reference to power cables, transformers, and generators. The following subjects are included: the limitations of conventional power systems; production and maintenance of low temperatures; behavior of engineering materials at low temperatures; the design, materials, and refrigeration of cryoresistive and superconducting cables; and the application of superconductivity to d.c. machines, a.c. power generators, and transformers. (LCL)

Heat Transfer and Fluid Flow

Refer also to abstracts 14298, 15279, 16290, 16424, 16459, and 16482.

14763 (AEC-tr-7295, pp 100-103) EXPERIMENTAL TEST-BED D1-P FOR TESTING MODELS OF HEAT EXCHANGERS. Pulyaev, V. F.; Russiyanov, A. F.; Yushko, V. A. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli i Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

This test bed is for the heat-transfer and hydrodynamic testing of models of condensers, regenerative evaporators, gas regenerators, and cassettes of nuclear reactors operating with the dissociating heat-transfer medium N_2O_4. The test bed operates on the closed-vapor cycle and includes all the heat-exchanger elements. The test bed and its operation are described. (DLC)

14764 (AEC-tr-7295, pp 148-152) SPECIAL COMPUTING SYSTEM FOR SIMULATING THERMOPHYSICAL PROPERTIES OF DISSOCIATING HEAT-TRANSFER MEDIUM. Shadskii, V. M. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli I Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

An analog-to-digital function converter, capable of working in conjunction with an analog computer, was developed for simulating the thermophysical properties of dissociating N_2O_4. Disassociating N_2O_4 may be used as a heat transfer medium in nuclear power plants. Circuit diagrams of the function generator of two variables and of three variables are presented and procedures for making calculations are described. (LCL)

14765 (AEC-tr-7295, pp 199-209) EXPERIMENTAL STUDY OF CONVECTIVE HEAT TRANSFER IN THE DISSOCIATING GASES. Devoino, A. N. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli I Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

Past experimental investigations on the convective heat transfer in disassociating N_2O_4 are described, and problems which must be solved by future experimental studies are enumerated. (LCL)

14766 (AEC-tr-7295, pp 210-215) QUASIFROZEN FLOW CRITERIA FOR DISSOCIATING GAS. Reisig, V. A.; Shchegolev, G. M. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli I Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

A method of determining the range of parameters characterizing the flow of disassociated gas with frozen composition is suggested. The case considered is of practical importance for the cooling or heating of the gas in slit-type heat exchangers, porous or perforated walls, in supersonic nozzles, shock waves, etc. (auth)

14767 (AEC-tr-7295, pp 224-232) HEAT AND MASS TRANSFER WITH CHEMICAL CHANGES IN REACTING BOUNDARY LAYER. Sergeev, G. T.; Tarasevich, L. I. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli I Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

Experiments performed to measure heat and mass transfer with chemical changes in a reacting boundary layer are discussed. The experimental apparatus consisting of a constant-action low-velocity wind tunnel, a porous metal plate, water cooling system, pressure controls, thermocouples, ethyl alcohol or hexane as the

reacting fluid, and flow meters is described. Empirical relations are developed which approximate the average heat and mass transfer data. (LCL)

14768 (AEC-tr-7295, pp 233-248) CALCULATION OF THE PARAMETERS OF CHEMICALLY REACTING FLOW THROUGH A HEATED CHANNEL. Nesterenko, V. B.; Tverkovkin, B. E.; Shinkevich, O. S.; Pleshchenkov, G. A. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli I Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

Past experimental studies indicate that the use of the chemically reacting N_2O_4 system as a heat transfer medium and working fluid in nuclear power plants with gas-cooled reactors is feasible, but further work on the use of this system has been hampered because no simple and reliable method is available which can be used for the engineering calculations of gas-cooled reactors and heat exchangers working on a chemically reacting heat transfer medium. A one-dimensional model was selected for the calculation of chemically reacting flow through the heated channel of a reactor, and a solution is presented to the problem of calculating the mean parameters of the chemically reacting flow. (LCL)

14769 (AEC-tr-7295, pp 249-260) SOLUTION OF SOME PROBLEMS OF THERMOPHYSICS BY APPROXIMATION METHOD. Gribkova, V. P. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli I Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

Approximate solutions to the problems of steady-state and transient thermal conductivity in chemically reacting gas flow are presented. (LCL)

14770 (AEC-tr-7295, pp 261-267) CALCULATION OF FLOW PARAMETERS UPON CONDENSATION OF THE SYSTEM $2NO + O_2$ IN EQUILIBRIUM $2NO_2$ IN EQUILIBRIUM N_2O_4 IN A TUBE. Mikhalevich, A. A.; Nesterenko, V. B.; Novikov, G. G. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli I Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

Using a one-dimensional analytical model, the change in parameters upon condensation of the system $2NO + O_2$ reversible $2NO_2$ reversible N_2O_4, of which the reaction $2NO + O_2$ reversible $2NO_2$ is mainly a nonequilibrium reaction and the constituents NO and O_2 are noncondensing gases in the practical range of temperatures and pressures, is considered. (auth)

14771 (AEC-tr-7295, pp 268-275) EXPERIMENTAL INVESTIGATION OF HEAT TRANSFER WITH PHASE CHANGE OF CHEMICALLY REACTING HEAT-TRANSFER MEDIA. Kolykhan, L. I. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli I Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

Heat transfer in disassociating systems was investigated experimentally with N_2O_4 boiling in a horizontal tube under conditions of natural convection at pressures from 2 to 10 atm and thermal loading up to 4×10^5 kcal/m^2 x h and in a vertical tube under conditions of natural circulation at pressures of 2 to 50 atm and thermal loading of from (3.5 to 17) x 10^4 kcal/m^2 x h. Although the absolute values of the heat transfer coefficients varied, a correlation between the coefficient of heat transfer and the coefficient of pressure peculiar to N_2O_4 was observed in all experiments. It was concluded that available experimental data are insufficient for reliable recommendation for the calculation of heat transfer coefficients with change of phase in chemically reacting systems. (LCL)

14772 (AEC-tr-7295, pp 276-283) EVAPORATION OF LIQUID DROPLETS IN A MEDIUM OF VARIABLE PROPERTIES. Dregalin, A. F.; Bychenok, V. I. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli I Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

In order to determine the evaporation rate of liquid fuel in a flow of high-temperature gas, the size distribution of the droplets, conditions of the surrounding gas flow, thermophysical properties of the evaporating constituent in liquid and vapor phases, and the properties of the gas must be known. A system of equations is presented, the solution of which will enable demonstration of the effect of variable composition and properties of the gas on the evaporation rate of the liquid droplets. (LCL)

14773 (AEC-tr-7295, pp 284-288) RESULTS OF EXPERIMENTAL INVESTIGATIONS OF HEAT TRANSFER IN BOILING NITROGEN TETROXIDE IN A VERTICAL TUBE. Bakalin, Yu. I.; Golubenko, G. G.; Kolykhan, L. I.; Sen'ko, A. S.; Solov'ev, V. N. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli I Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

Heat transfer for disassociating N_2O_4 during boiling in a vertical tube under conditions of natural circulation were studied. Data on the effects of heat flux and pressure on the coefficient of heat transfer are presented. The investigations indicated that heat transfer in boiling chemically reacting systems differs from the heat transfer in boiling inert pure substances. Therefore, care should be taken in calculating the coefficient of heat transfer for the reacting system, on the basis of the existing criterial and empirical correlations. (LCL)

14774 (INR-1483/9/R/B) UNSTEADY THREE-DIMENSIONAL TEMPERATURE FIELD-VARIATIONAL APPROACH. Lach, J. (Institute of Nuclear Research, Warsaw (Poland)). 1973. 33p. (In Polish). INIS.

A direct variational method is presented for solving an unsteady three-dimensional heat transfer problem with linear boundary conditions of the third kind. The formulation satisfies the conditions necessary for the existence of a variational integral. Special conditions which allow the construction of an approximate solution are also presented. (auth)

14775 INR-1486/9/R/B) LAMINAR FLOW WITH NON-LINEAR BOUNDARY CONDITION. Lach, J. (Institute of Nuclear Research, Warsaw (Poland)). 1973. 13p. (In Polish). INIS.

An application of the variational calculus to an analysis of the generalized Graetz-Nusselt problem (with the third kind nonlinear boundary condition) is presented. The local Nusselt number distribution was determined as a function of the dimensionless axial coordinate. Good agreement was obtained with previous experimental results. (auth)

14776 COMPUTATION OF THE AVERAGE GROWTH RATE OF VAPOR BUBBLES. Tolubinskii, V. I. (Engineering Thermophysics Inst., Kiev). Heat Transfer—Sov. Res.; 7: No. 3, 77-83 (1975).

Translated from Teplofiz. Teplotekh.; 26: 3-9(1974).

The theory of similitude equations incorporating the rate of vapor bubble is presented, and recommendations are given for computing this rate. The equation allows calculating the heat transfer in the boiling of a variety of liquids. (auth)

14777 UNSTEADY TWO-PHASE HEAT TRANSFER IN A VERTICAL PIPE HEATED BY DRY SATURATED STEAM. Pereverzev, D. A.; Shpak, V. Ya. (Thermophysics Inst., Kharkov). Heat Transfer—Sov. Res.; 7: No. 3, 71-76(1975).

Translated from Teplofiz. Teplotekh.; 26: 132-136(1974).

Approximate mathematical model of nonlinear heat transfer via a condensate film for heating of smooth and rough walls of an insulated vertical pipe with steam were developed and evaluated on a computer. The quantities determined were film thickness-

heat transfer coefficients, condensate flowrates, and the temperature field of the solid walls. (auth)

14778 HEAT TRANSFER CRISIS IN ANNULI WITH COSINUSOIDAL HEAT RELEASE ALONG THE LENGTH. Ornatskii, A. P.; Chernobay, V. A.; Vasil'ev, A. F.; Perkov, S. V. (Polytechnic Inst., Kiev). Heat Transfer–Sov. Res.; 7: No. 3, 66-70(1975).
Translated from Teplofiz. Teplotekh.; 26: 102-107(1974).
Data on heat transfer crisis in annuli with cosinusoidal heat release along the length and a maximum heat flux in the middle are presented. A relationship is presented for determining N_{cr} or q_{cr} in annuli with uniform and cosinusoidal release of heat along the length. (auth)

14779 BOILING "CRISIS" GENERATED UPON A STEEP INCREASE ON POWER IN HEATERS WITH DIFFERENT HEAT CAPACITIES (TUBE-WALL THICKNESSES). Tolubinskii, V. I.; Ostrovskii, Yu. N.; Pisarev, V. E. (Engineering Thermophysics Inst., Kiev). Heat Transfer–Sov. Res.; 7: No. 3, 31-34(1975).
Translated from Teplofiz. Teplotekh.; 26: 139-142(1974).
Experimental data are presented on "unsteady" critical heat fluxes for water, ethanol, and acetone as a function of the heater wall thickness. A fact of interest is the effect of the heating element wall thickness on the first boiling crisis. (auth)

14780 CURRENT THEORIES OF NUCLEATE BOILING OF LIQUIDS. Labuntsov, D. A. Heat Transfer–Sov. Res.; 7: No. 3, 1-15(1975).
Translated from Teploobmen i Fizicheskaya Gazodinamika; 98-115(1974).
The theoretical and experimental studies concerned with the boiling of liquids are reviewed. The possible external models of bubble growth are critically analyzed, and a new model is suggested. It yields, on the basis of current understanding of nucleate boiling, relationships for the bubble departure diameter. (auth)

14781 APPROXIMATE METHOD FOR CALCULATING THE DRYING AND HEATING OF POLYDISPERSE MATERIALS IN TWO-PHASE FLOW. Babukha, G. L.; Shrayber, A. A. (Engineering Thermophysics Inst., Kiev). Heat Transfer–Sov. Res.; 7: No. 3, 119-123(1975).
Translated from Teplofiz. Teplotekh.; 26: 15-19(1974).
The computation of heat and mass transfer between flowing gas and a polydisperse material suspended in it is described. The method accounts for variation of flow variables and physical properties along the flow, as well as for the thermal resistance of the particulate material. (auth)

14782 TEMPERATURE MEASUREMENT, 1975. Conference on Temperature Measurement, Teddington, England, 9–11 April 1975. Billing, B. F.; Quinn, T. J. (eds.). London; Institute of Physics (1975). 467p. (CONF-750490-).
A separate abstract was prepared for one of the fifty-one papers presented. The remaining papers were not in scope for NSA. (TFD)

14783 CONSTRAINED OSCILLATIONS OF A TWO-PHASE GAS-LIQUID FLOW IN A DUCT. I. Theory. Glikman, B. V.; Raletnev, V. I. Izv. Akad. Nauk SSSR, Energ. Transp.; No. 4, 138-148(1975). (In Russian).
The solution of the problem of small constrained oscillations of a two-phase two-component flow in a homogeneous tract with a local hydraulic drag on its end is presented in an approximation of a one-velocity model considering a one-dimensional adiabatic nonstationary motion of a gas-liquid flow in a cylindrical tube. A system of third order equations is derived which characterizes the propagation of damped acoustic waves of compression and progressive undamped concentration waves. The analysis includes the interaction of acoustic and concentration waves and the dynamic characteristics of the duct with two-phase flow in presence of concentration waves. The essential effect of the mean radius of bubbles in the flow on the dynamic characteristics of the duct, owing to the unbalanced heat exchange between the gas in the bubble and the liquid, is emphasized. (JPRS)

14784 CONTRIBUTION TO THE SUPERHEAT OF SODIUM AT THE INCIPIENCY OF BOILING. Spiller, K. H.; Grass, G.; Droste, D. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). Atomkernenergie; 26: No. 2, 93-98(1975).
17 figs.; 2 tabs.; 5 refs.
As it is known, alkali metals tend to be superheats. Mechanical surface treatments and pickling had little or no influence. Nitriding of stainless steel surfaces causes the incipient boiling superheat of sodium to be completely suppressed. Only the smaller steady state boiling superheat remains. The effect is based on a diminution of wetting, as it seems. A simple solution is given to avoid a restriction of heat flux by the treatment for the diminution of wetting. (DE)

14785 FILM BOILING HEAT TRANSFER FROM SMALL SPHERICAL PARTICLES TO SATURATED SODIUM AND WATER. Farahat, M. M.; Nasr, T. N. (Alexandria Univ. (Egypt). Inst. of Nuclear Engineering). Atomkernenergie; 26: No. 2, 99-102(1975).
12 figs.; 14 refs.
The interaction of hot spherical particles with saturated sodium and water coolants at atmospheric pressure was studied. Natural convection film boiling was assumed to be the mode of heat transfer during most of the interaction. The particles studied varied in dia from 0.5 to 3.5 cm, and were at temperatures of 460 to 2350°C. A boundary layer type of analysis was assumed for the steady-state problem. The resulting solution gave the dependence of the vapour film thickness and film heat transfer coefficient on the angular position around the spheres. The effect of particle dia on film thickness and heat transfer coefficient was also determined. A comparison was made between sodium and water vapour films for 2.5 cm spheres at 1350°C. It is clearly shown that the film heat transfer coefficient increases rapidly as the particle size decreases. This, added to the increase in surface area may explain the unusually violent interaction with coolants during fragmentation of hot fuel particles. (DE)

Materials Testing

Refer also to abstracts 14753 and 14754.

14786 (AEC-tr-7315, pp 162-169) PHOTOGRAPHIC INTENSIOMETRY OF gamma-RADIATION IN RADIOGRAPHY. Serebrennikov, I. Ya.; Karavaev, S. P.; Sul'kin, A. G.; Firstov, V. G. 1971. Translated from Radiats. Tekh.; No. 6, (1971).
In Radiation Technology, Issue 6.
The use and performance of scintillation counters for calibrating gamma exposures for gamma radiography are described. (WHK)

14787 (AEC-tr-7315, pp 177-186) METHOD FOR THE PREPARATION OF REFERENCE SYMBOLS FOR RADIOGRAPHY. Chubkov, V. N.; Solntsev, V. V.; Chupkov, V. M.; Zotov, A. I. 1971. Translated from Radiats. Tekh.; No. 6, (1971).
In Radiation Technology, Issue 6.
A method for the preparation of symbols for marking radiographs is described. (TFD)

14788 (AEC-tr-7315, pp 192-195) SOME RESULTS OF THE EXPLOITATION OF THE gamma-FLAW DETECTOR "TRASSA". Khoroshev, V. N.; Maiorov, A. N.; Galash, T. F. 1971. Translated from Radiats. Tekh.; No. 6, (1971).
In Radiation Technology, Issue 6.
Quality control of welded joints in gas and oil pipelines using the "Trassa" flaw detector is described. (TFD)

14789 (AEC-tr-7315, pp 207-212) HOSE gamma-FLAW DETECTOR "KAMA" WITH A POWERFUL RADIATION SOURCE. Mairov, A. N.; Grachev, A. V.; Kuleshov, A. V.; Galkin, S. G.; Naugol'nykh, B. L.; Goncharov, V. I.; Lopatin, V. V.; Sakhanov, A. S. 1971. Translated from Radiats. Tekh.; No. 6, (1971).
In Radiation Technology, Issue 6.
The design and operating parameters of the "Kama" flaw detector are described. The detector uses a ^{60}Co source and is used to inspect articles with complex configurations, building constructions, and joints and components located in places inaccessible with conventional-type equipment. (TFD)

14790 (AEC-tr-7315, pp 212-217) ECONOMIC EFFECTIVENESS OF THE INTRODUCTION OF NEW TYPES OF gamma-FLAW DETECTORS IN INDUSTRY. Komarova, Yu. P.; Akopov, V. S. 1971. Translated from Radiats. Tekh.; No. 6, (1971).
In Radiation Technology, Issue 6.
A review of the technico-economic effectiveness of new and advanced types of gamma flaw detectors introduced into the USSR industry is presented. The detectors examined include Gasprom, RID-21, Labirint, Trassa, Neva, Polyus, Stapel, RID-22, Arktika, and Kama. (TFD)

14791 NEW METHODS OF NON-DESTRUCTIVE TESTING OF METALLIC MATERIALS. Hoeller, P. VDI (Ver. Dtsch. Ing.) Ber.; No. 230, 43-50(1975). (In German)
12 figs.; 10 refs.
New developments in eddy current testing for the detection and description of faults and the measurement of cross sections are dealt with. Also discussed is the structural analysis of polycrystalline metals by ultrasonic scattering. (DE)

14792 SURFACES UNDER ION BOMBARDMENT. The Static Method of the Secondary Ion Mass Spectroscopy for the Surface Analysis of Solids. Benninghoven, A. VDI (Ver. Dtsch. Ing.) Nachr.; 29: No. 30, 1, 7(Jul 1975). (In German)

2 figs.

The analysis of solid surfaces is no longer considered merely a part of physical and chemical basic research: the technical significance of this field, whether for the investigation of elementary processes of corrosion, for catalyst research, or for plasma analysis, is becoming increasingly important. The rapid development of the surface analysis in the recent years is also greatly due to the static process of the secondary ion mass spectroscopy. This method has definite advantages, compared to the other surface analytical methods based on the energy analysis of electrons emitted, which enable new applications. The possibilities of determining chemical compounds on solid surfaces, of differentiating isotopes, or of detecting hydrogen with great sensitivity are of interest in the chemical industry, materials science, nuclear physics, reactor technology, air and space travel, medicine, and biology. (DE)

14793 ACOUSTIC TRANSDUCER WITH METHOD OF CONSTRUCTION. Smith, R. W.; Adamson, G. E. (to Energy Research and Development Administration, Washington, D. C. (USA)). German(FRG) Patent 2,436,328/A/. 20 Feb 1975. 15p. (In German)

The design is given for a transducer suited for application at high temperatures in the presence of active corrosive sodium. Its basic element is a piezoelectric active element enclosed in a casing of sodium-compatible material such as stainless steel. The lead zirconate or lead titanate ceramic crystal, together with the rear side of the transducer front plate, is connected coaxially to an ultrasonic transducer lens. The transducer lens is a concave cutout segment in the bottom side of the transducer front plate. A spring-loaded contact piece provides the electrical connection of the back electrode of the crystal. A supporting element between the rear side of the crystal and the contact piece serves to maintain the electrical voltage between them. The supporting element consists of a loosely interweaved wire ball with multiple points of contact between the contact piece and the crystal, but it may also be an attenuator pad of high-temperature silicon rubber with a heavy addition of tungsten powder. (DE)

14794 REMARKS ON THE PRODUCTION OF THIN FOILS FOR THE TRANSMISSION ELECTRON MICROSCOPE USING ION BOMBARDMENT. Molcik, M. (Ceskoslovenska Akademie Ved, Brno. Vyzkumny Usta Kovu). Prakt. Metallogr.; 12: No. 6, 299-311(Jun 1975). (In English, German)

9 figs.; 7 refs.

Ion bombardment in vacuo leads to a characteristic etching effect on originally shiny surfaces of metallic targets, which is undesirable in thin metallic foils for transmission electron microscopy. The causes of this phenomenon was investigated using types of apparatus for thin foil production. Several reasons for the etching effect were discovered, but it was not possible to suppress the phenomenon by altering the operating conditions. (DE)

14795 ZERSTOERUNGSFREIE PRUEFVERFAHREN: PRUEFUNG VON SCHWEISSVERBINDUNGEN METALLISCHER WERKSTOFFE MIT ROENTGEN- ODER GAMMASTRAHLEN. Aufnahme von Durchstrahlungsbildern. (Non-Destructive Testing: Testing of Welds of Metallic Materials by X- or Gamma-Rays. Photography of Transmission Radiograms). Berlin, F. R. Germany; Beuth (Nov 1973). 8p. (In German). (DIN-54111(Bl.1)).

17 figs.; 5 tabs.

This standard will serve to assure an image quality of transmission radiograms of welded joints which is adapted to the workpiece and in keeping with the present state of testing. The demands made on the image quality using only standardized image quality controls do not give full assurance of an optimum image quality; the principles and empirical values of testing stated in this standard will have to be observed additionally. (DE)

14796 ZERSTOERUNGSFREIE PRUEFUNG: BILDGUETE VON DURCHSTRAHLUNGSAUFNAHMEN AN METALLISCHEN WERKSTOFFEN. Begriffe, Bildguetepruefkoerper, Ermittlung der Bildguetezahl. Entwurf. (Non-Destructive Testing: Image Quality of Radiographs of Metallic Materials. Terms, Image Quality Indicators, Determination of Image Quality Values. Draft). Berlin, F. R. Germany; Beuth (Apr 1975). 3p. (In German). (DIN-54109(Bl.1)).

1 fig.; 2 tabs.

This draft standard is to provide the basis for a standardized assessment of the image quality of radiographs of metallic materials. (DE)

14797 APPLICATION OF ACOUSTIC EMISSION ANALYSIS TO THE DETERMINATION OF CRACK FORMATION AND GROWTH. Crostack, H. A.; Roeder, E. (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Bremen (F.R. Germany). Inst. fuer Angewandte Materialforschung). Maschinenschaden; 48: No. 1, 17-22(1975). (In German).

5 figs.; 30 refs.

Acoustic emission testing is useful in the testing of mechanical structures as well as in the study of materials. It allows the early detection and localization of critical faults and thus ensures timely remedial measures. The various possibilities of application of this method are indicated and explained. (DE)

Nuclear Explosions

Refer also to abstracts 14611, 14835, and 16451.

14798 (AD/A-005434) ANALYSES OF GROUND MOTIONS FROM CONTAINED BURSTS IN GREENSTONE BASALT. Final Report, 13 March 1973-15 February 1974. Wagner, M. H.; Georke, W. S.; Kreyenhagen, K. N. (California Research and Technology, Inc., Woodland Hills (USA)). 14 Nov 1974. Contract DNA001-73-C-0182. 60p. (CRT-2010-2). NTIS $4.25.

A series of contained burst calculations were performed to evaluate two different approaches for modeling the properties of an in situ rock field, and to examine some of the effects of porosity upon predicted ground motions. The basic material in the study was greenstone basalt. Results of the calculations were compared with the trends shown by ground motion data from a large number of contained burst tests in hard rock media. (GRA)

14799 (AD/A-005665) RESEARCH ON SEISMOLOGY. Semiannual Technical Report, 1 May-31 October 1974. Stauder, W. (Saint Louis Univ., Mo. (USA). Dept. of Earth and Atmospheric Sciences). 1974. Contract F44620-73-C-0042. 68p. NTIS $4.25.

See also AD-784958.

Topics discussed include: spectral characteristics of the Lg wave generated by Central US earthquakes; ground motion modelling at regional distances for earthquakes in a continental interior; regional Rayleigh wave attenuation in North America; surface wave attenuation in Eurasia; and radiation from shallow focus earthquakes in the Sakhalin and Kurile Islands. (GRA)

14800 (AD/A-005703) NORWEGIAN SEISMIC ARRAY (NORSAR). Semiannual Technical Report, 1 January-30 June 1974 on Phase 3. Bungum, H. (Norges Teknisk-Naturvitenskapelige Forskningsraad, Kjeller. NORSAR). 1 Sep 1974. Contract F44620-74-C-0001. 102p. NTIS $5.25.

The reports on surface-wave studies include one describing a recently initiated study of source mechanisms for North Atlantic earthquakes. Work on actual explosion data includes one report on nonlinear instrumental response to strong long-period P-waves, and one describing the continued work on m_b: M_s at NORSAR. Also, a comment on the effect of multipathing on single-station group velocity analysis is given. (GRA)

14801 (AD/A-005708) STRAIN/INERTIAL SEISMOGRAPH COMPLEXES. Fix, J. E. (Teledyne Geotech, Garland, Tex. (USA)). 5 Mar 1974. Contract F08606-73-C-0008. 302p. NTIS $9.25.

The purposes of this report are to present the results of a comprehensive review of the state-of-the-art of strain seismographs and their applications and to present the cost/performance tradeoffs between spatial arrays and strain/inertial arrays. The review included: strain seismometer operating characteristics, present designs, and possible future designs; installation methods, techniques, and configurations; applications of combined strain and inertial seismograms including detection thresholds of the prototype station; the character and magnitude of the strain noise field; and budgetary costs for typical installations. (GRA)

14802 (AD/A-006135) RESEARCH FOR DETERMINING PROPAGATION CHARACTERISTICS FOR ARPA'S NORWEGIAN ARRAY. Landisman, M. (Texas Univ., Dallas (USA). Richardson Center for Advanced Studies). 27 Sep 1974. Contract F19628-73-C-0285. 12p. NTIS $3.25.

The first annual report narrates a program of research directed toward measuring the propagation delay for a number of different, individually dispersed seismic surface wave trains which are observed by the long period elements of ARPA's Norwegian Large Seismic Array, during the passage of disturbances from sufficiently energetic, distant, sub-crustal seismic events. It is expected that the availability of these improved delay measurements can help to improve the detection, identification, and location capabilities of the array. (GRA)

14803 (AD/A-006437) FINAL REPORT, PROJECT T/3703, AUGUST 1972 THROUGH JANUARY 1974. Sherwin, J. R.; Kraus, G. C. (Teledyne Geotech, Garland, Tex. (USA)). 24 Sep 1974. Contract F08606-73-C-0008. 67p. NTIS $4.25.

Ten portable seismograph systems were deployed to record data from the Project RIO BLANCO detonation. A preliminary visual analysis of the data recorded at the field sites was performed. Three task change proposals were accepted by the project office and a considerable portion of the total effort of this project was devoted to these tasks. A program to test and evaluate the borehole seismometer system, model 36000, was conducted. In the second major task, documentation for the production design of the model 36000 was completed, along with all necessary accessories, such as the test set/controller, model 37960. Also, a second experimental model 36000 was delivered to the government for independent evaluation. In the final task, a study of the requirements and capabilities of strain/inertial seismograph complexes was completed. (GRA)

14804 (AD/A-006467) IDENTIFICATION OF EARTHQUAKES AND UNDERGROUND EXPLOSIONS. Final Technical Report. Herrin, E. (Southern Methodist Univ., Dallas, Tex. (USA). Dallas Geophysical Lab.). Feb 1975. 165p. NTIS $6.25.

Research during the reporting period was accomplished in four categories: (a) analysis of Rayleigh wave dispersion for polar paths; (b) development of improved array processing techniques; (c) determination of bias in network computations of body wave magnitudes; and (d) investigation of the effect on the Rayleigh spectrum of lateral heterogeneity in earthquake source regions. Because of the uniformity of group velocity dispersion within the polar waveguide and the broad-band nature of the Rayleigh waves, "matched" or chirp-filter techniques were found to be particularly effective on data recorded at McKinney, TX, site. (GRA)

14805 (AD/A-006683) DEVELOPMENT OF A LONG DURATION FLOW FACILITY FOR STUDIES OF BLAST–FIRE INTERACTION. Final Report. Boyes, J. H.; Kennedy, M. P.; Wilton, C. (URS Research Co., San Mateo, Calif. (USA)). Jun 1974. Contract DAHC20-73-C-0195. 84p. (URS–7239-6). NTIS $4.75.

The study reports on the conversion of an underground complex into a Long Duration Flow Facility (LDFF), the calibration of the facility, and a limited test program to study the effect of long duration pressure pulses on extinguishing materials simulated to have been ignited by the coincident thermal pulse (so-called "blast-fire" interaction). High speed photographic cameras and pressure-sensing gauges instrument the test room. Three blast-fire interaction tests were conducted and it was found that the blast wave extinguished initial fires, but would not extinguish smoldering fires in upholstered materials such as mattresses. These tests demonstrated the usefulness of the facility. (GRA)

14806 (PB-239088) READY I SYSTEM. Attack Conditions Program. Technical Manual (Final). (National Resource Evaluation Center, Washington, D. C. (USA)). Mar 1967. 34p. (NREC-TM-191). NTIS $3.75.

The attack conditions program is designed to provide the READY I weapon effects program with a file containing weapon fallout trajectories. The program is designed to be run on a CDC 3600 computer in conjunction with the READY I damage assessment system. (GRA)

14807 (PB-239293) READY I SYSTEM FOR THE UNIVAC 1108 WEAPONS EFFECTS PROGRAM. Revision No. 1. Final Report. (General Services Administration, McLean, Va. (USA). Mathematics and Computation Lab.) Nov 1974. 34p. (GSA/OP/MCL-TM-231(Rev. 1)). NTIS $3.75.

Supersedes report No. PB-226215.

This computer program, part of the READY I system, computes the effects of a specific nuclear attack on a set of resource points and produces a binary output tape containing the computed information. (GRA)

14808 (PB-239295) READY I SYSTEM FOR THE UNIVAC 1108 ATTACK CONDITIONS PROGRAM. Revision No. 1. Final Report. (General Services Administration, McLean, Va. (USA). Mathematics and Computation Lab.). Nov 1974. 31p. (GSA/OP/MCL-TM-235(Rev. 1)). NTIS $3.75.

Supersedes report No. PB-224855.

The attack conditions program is designed to provide the READY I weapon effects program with a file containing weapon fallout trajectories. The program is designed to be run on a UNIVAC 1108 computer in conjunction with the READY I damage assessment system. (GRA)

14809 FIELD MEASUREMENT OF RELATIVE GROUND DISPLACEMENT. Donovan, N. C. (Dames and Moore, San Francisco); Degenkolb, H. J. pp 10-16 of Proceedings of U. S. National Conference on Earthquake Engineering 1975. Oakland, CA; Earthquake Engineering Research Institute (1975).

From U. S. national conference on earthquake engineering; Ann Arbor, Michigan, USA (18 Jun 1975). See CONF-7506107-.

Protection of existing structures is a major requirement during underground nuclear blasts detonated as part of the Plowshare Program. Instrumental arrays to record ground motion are routinely established prior to blasts. These provide data on particle motions during the event but do not provide direct information concerning ground strains and relative displacements which may effect bridges, buildings, irrigation channels and other structures with large plan dimension. An experimental technique which was hastily developed and deployed to measure relative displacements during the Rio Blanco event of May 17, 1973 is described. The work was performed in anticipation of the Project Wagon Wheel in an area of Wyoming with many concrete lined irrigation channels. (auth)

Protective Structures and Equipment

Refer also to abstract 16509.

14810 (AD/A-006289) USE OF SOIL AS AN EXPEDIENT COUNTERMEASURE FOR RURAL FALLOUT SHELTERS. Final Report. Cohen, M. O.; Beer, M. (Mathematical Applications Group, Inc., Elmsford, N. Y. (USA)). Oct 1974. Contract DCPA01-74-C-0220. 49p. (MR-7042). NTIS $3.75.

A series of SAM-CE Monte Carlo calculations has been performed to evaluate the effectiveness of the use of soil as an expedient countermeasure for rural fallout shelters. The shelters considered were a small wood frame house, a larger wood frame structure and the wing of a school building. Fallout exposures rates, at different locations within these structures, were determined for countermeasures involving various amounts of soil loaded on the roof and bermed against the outer walls. In all cases, the fallout field was assumed to be a pure ^{60}Co source which was infinite in extent. The results show that the maximum countermeasure considered upgraded the rural structures considerably and provided protection factors in the 20 to 40 range. (GRA)

14811 (AD/A-006682) SHOCK TUNNEL TESTS OF ARCHED WALL PANELS. Final Report, November 1972–October 1973. Gabrielsen, B.; Wilton, C. (URS Research Co., San Mateo, Calif. (USA)). Jul 1974. Contract DAHC20-71-C-0223. 231p. (URS-7030-19). NTIS $7.50.

See also report dated Jan 1972, AD-747331.

The objectives of this program were to determine the failure strengths of wall panels typical of those found in existing buildings, and in particular wall panels found in those buildings which contain designated fallout shelter spaces. Brittle materials, such as brick and concrete block, were the primary materials investigated. Fullscale walls (8½ ft by 12 ft), with and without window or door openings, were exposed to air-blast waves in the URS shock tunnel. Concurrently, an analytical study of the mechanical properties of these construction materials was undertaken to link test results with prediction theory. It was found that walls which were fitted very snugly into a frame (rigid arching) were considerably stronger than no-arched (i.e., gapped) walls (with failure overpressure four-to-five times those from non-arched walls), but not as strong as previous theory would suggest. Walls with a small gap, however, were only slightly stronger than non-arched walls. (GRA)

ENVIRONMENTAL AND EARTH SCIENCES

Refer also to abstracts 14825 and 14836.

14812 (PB-238928) GRANTS ACTIVITIES SUPPORTED BY THE ENVIRONMENTAL CONTROL ADMINISTRATION OF THE ENVIRONMENTAL HEALTH SERVICE: FISCAL YEAR 1969. Moore, R. T.; Sabo, J. J.; Vankirk, D. M. (Environmental Control Administration, Rockville, Md. (USA)). 1970. 568p. NTIS $13.00.

A register of the grants programs of the five bureaus which make up the Environmental Control Administration is presented. These bureaus are Bureau of Community Environmental Management, Bureau of Occupational Safety and Health, Bureau of Radiological Health, Bureau of Solid Waste Management, and Bureau of Water Hygiene. The register includes a summary of objectives and significant results of the grants research. (GRA)

14813 (UCRL-51943) SAN FRANCISCO BAY AND DELTA SYSTEM: A SELECTED BIBLIOGRAPHY. Buchanan, M. F.; Ritschard, R. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jun 1975. Contract W-7405-Eng-48. 496p. Dep. NTIS $10.60.

A selected bibliography of over 2500 references describing the prevailing conditions of the San Francisco Bay and the Sacramento-San Joaquin Delta system is detailed. Seven major categories--Environmental Studies, Physical Sciences, Aquatic Studies, Effects, Waste Management, Water, and Related Resources and Legal Studies, are further divided into twelve subject headings with extensive cross-referencing. Geographical designations are: Sacramento-San Joaquin River and Delta System; San Francisco Bay; and San Francisco Bay Area. Each major category is preceded by a section of general related references. (auth)

14814 LEGAL ASPECTS OF THERMAL DISCHARGES. Martin, A. J. (Power Authority of State of New York). J. Hydraul. Div., Am. Soc. Civ. Eng.; 100: No. HY7, 1059-1069 (Jul 1974).

Application of the Federal Water Pollution Control Act-Amendments of 1972 to thermal discharges is discussed. This law imposes constraints on existing discharge sources by utilizing effluent limitations and water quality standards while proposed or new sources are governed by federal performance standards. A joint federal-state effort is described in which states are responsible for pollution abatement in their respective waters, while the federal government lends direction and assistance, and oversees the state effort. However, a difference of opinion exists concerning the proper statutory approach to be followed in the regulation of thermal discharges, with the EPA supporting strict numerical criteria and states such as New York favoring flexible criteria modifiable to fit particular conditions on a case-by-case basis. (Pollut. Abstr.)

14815 ENZYMIC FORMATION OF 6-OXOBENZO[a]PYRENE RADICAL IN RAT LIVER HOMOGENATES FROM CARCINOGENIC BENZO[a]PYRENE. Lesko, S.; Caspary, W.; Lorentzen, R.; Ts'o, P. O. P. (Johns Hopkins Univ., Baltimore). Contract AT(11-1)-3280. Biochemistry; 14: No. 18, 3978-3984(9 Sep 1975).

From 19th annual meeting of the Biophysical Society; Philadelphia, PA (1975).

Upon incubation of benzo[a]pyrene (B[a]P) at 37° in rat liver homogenates fortified with NADPH generating cofactors, a metabolite was formed which gave rise spontaneously to an electron paramagnetic resonance (EPR) signal. The radical and its metabolic precursor were extracted into benzene for measurement, in which they are relatively stable. The EPR signal was identical with that extracted after incubating synthetic 6-hydroxybenzo[a]pyrene (6-OH-B[a]P) in rat liver homogenates and has been identified as the 6-oxobenzo[a]pyrene radical by its characteristic hyperfine structure. No EPR signal was detected when benzo[a]pyrene or cofactors were eliminated from the incubation mixture or when the homogenate was heated. The radical concentration reached a peak after 14-15 min of incubation and declined rapidly to a low level at 20 min. The decay of 6-hydroxybenzo[a]pyrene in rat liver homogenate did not appear to be enzymic and showed a first-order rate constant of 0.29 min^{-1} and a half-life of 2.4 min. The only significant products formed by oxidation of 6-hydroxybenzo[a]pyrene in rat liver homogenates were: 6,12-B[a]P dione (15 percent), 1,6-B[a]P dione (41 percent), and 3,6-B[a]P dione (44 percent). Formation of 6-OH-B[a]P was found to represent about 18 and 20 percent of total metabolism for female Sprague-Dawley rats and female ACI rats, respectively. The data indicate that 6-OH-B[a]P is a major metabolite of benzo[a]pyrene. This metabolite is very labile, being readily oxidized to the 6-oxobenzo[a]pyrene radical which is a transient intermediate in the further oxidation to quinones. (auth)

14816 WATER FOR THE HUMAN ENVIRONMENT. Volume II. Country Reports. Proceedings of the First World Congress on Water Resources, Chicago, Illinois, September 24-28, 1973. Chow, V. T.; Csallany, S. C.; Krizek, R. J.; Preul, H. C. (eds.). Champaign, IL; International Water Resources Association (1973). 534p. (CONF-7309143-P2).

From 1st world congress on water resources; Chicago, Illinois, USA (24 Sep 1973).

Thirty-four papers were presented covering water resources and management efforts relative to energy planning and pollution control for Africa, Asia, Middle East and Oceania, Europe and the U.S. One paper was separately abstracted for NSA. (PCS)

For an abstract of an individual paper see: 14865.

Minerals and Ores

Refer also to abstract 15522.

14817 (ERDA-tr-90) PRODUCTION OF CONCENTRATES FOR SUPPLYING A NATIONAL NUCLEAR ELECTRIC PROGRAM. Delgado, C. M. (Instituto Nacional de Energia Nuclear, Mexico City). Jul 1975. Translated from conference on nuclear electric energy and applications in Latin America. (CONF-750752-1). 25p. Dep. NTIS $4.50.

From conference on nuclear electric energy and applications in Latin America; Mexico City, Mexico (Jul 1975).

An analysis was made of the yearly requirements of natural U to satisfy a nuclear power program in Mexico. On the basis of these requirements an evaluation was made of the concentrate production necessary to supply those needs. The lack of known commercial reserves to satisfy the concentrate needs is shown. An estimation is made of the costs for the discovery and exploitation of sufficient reserves. In evaluating the U needs and associated costs, three cases were considered: all BWR or PWR or HWR. (JSR)

14818 (GJO-1640) VEIN-TYPE URANIUM DEPOSITS. Rich, R. A.; Holland, H. D.; Petersen, U. (Harvard Univ., Cambridge, Mass. (USA). Dept. of Geological Sciences). 10 Oct 1975. Contract AT(05-1)-1640. 383p. Dep. NTIS $10.75.

A critical review is presented of published data bearing on the mineralogy, paragenesis, geochemistry, and origin of vein-type uranium deposits. Its aim is to serve as a starting point for new research and as a basis for the development of new exploration strategies. During the formation of both vein and sandstone types of deposits uranium seems to have been dissolved by and transported in rather oxidized solutions, and deposited where these solutions encountered reducing agents such as carbon, sulfides, ferrous minerals and hydrocarbons. Granitic rocks abnormally enriched in uranium have apparently been the most common source for uranium in vein-type deposits. Oxidizing solutions have been derived either from the surface or from depth. Surface solutions saturated with atmospheric oxygen have frequently passed through red bed or clean sandstone conduits on their way to and from uranium source rocks. Deep solutions of non-surface origin have apparently become sufficiently oxidizing by passage through and equilibration with red beds. The common association of clean sandstones or red beds with uranium-rich granites in the vicinity of vein-type uranium deposits is probably not fortuitous, and areas where these rock types are found together are considered particularly favorable targets for uranium exploration. (auth)

14819 (INIS-mf-1664) U_3O_8: 1971 ANNUAL REPORT. (Uranium Canada Ltd., Ottawa, Ontario). Jun 1972. 16p. (In English and French). INIS.

Uranium Canada Ltd. (UCAN) was incorporated June 21, 1971, as a Canadian Crown Corporation and charged with the responsibility to hold title to the Crown's share of the joint venture uranium stockpile (with Denison Mines Ltd.) and to act as sales agent for the general government uranium stockpile. Sales agreements with Spanish utilities are in the process of settlement. Financial statements are presented which indicate the size and value of the joint stockpile. (INIS)

14820 (TID-3357) NUCLEAR RAW MATERIALS: A SELECTED BIBLIOGRAPHY. (Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center). Jan 1976. 48p. Dep. NTIS $4.00.

The bibliography contains 273 citations of reports placed on open file for examination at ERDA's Grand Junction Office. These citations cover reserves, exploration, and feed processing, but exclude logs of government drill holes, maps, and cross sections. (LK)

14821 NATURAL URANIUM. Maget, P. (CEA Direction des Productions, 92-Chatillon (France)). Ind. Miner. (Paris); 57: No. 5, 247-261(May 1975). (In French)

The following subjects are discussed: economic aspects of the use of uranium for energy production; world uranium resources; mining production in 1974; ore processing, especially methods of recuperating impoverished ores; the concentrate market; transformation of uranium; the supply policy. (FR)

14822 OCCURRENCE OF DISSEMINATED URANINITE IN WHEELER BASIN, GRAND COUNTY, COLORADO. Young, E. J.; Hauff, P. L. J. Res. U.S. Geol. Surv.; 3: No. 3, 305-311(1975).

Disseminated uraninite occurs in Wheeler Basin, Grand County, Colo., about 5 mi (8 km) southeast of Monarch Lake, in Precambrian metamorphic rocks consisting of migmatized gneiss and mixed gneiss and pegmatite. An intrusion of Precambrian Y Silver Plume Granite lies within 400 ft (122 m) of the occurrence. The disseminated uraninite is confined to parts of the host rock that are rich in biotite; highest grade found was 0.73 percent uranium. The disseminated uraninite occurs as cubes and grains, generally from 0.1 to 0.3 mm across. Unit cell edge of the uraninite, approximately 5.48 A, suggests its pegmatitic origin. The origin of the uraninite disseminations is attributed by us to remobilization and concentration of elements during metamorphism caused by the intrusion of Silver Plume Granite. Uranium and lead isotopic analyses by K. R. Ludwig of uraninite and monazite from biotite concentrations confirm an apparent age of 1,450 ± 20 m.y. for these minerals. This age is equivalent to that reported for the Silver Plume Granite. Although the Wheeler Basin occurrence is small in size, it has many similarities to the Roessing uranium deposit in South-West Africa. (auth)

14823 RESULTS OF THE OKLO CONFERENCE. Nachr. Chem. Tech.; 23: No. 15, 333-334(Aug 1975). (In German)

Not one but at least six independent natural nuclear reactors have been discovered in Oklo-Gabon, according to a statement made in June at an IAEA meeting at Libreville/Gabon. Their exact number will be known only after uranium mining has been continued for some time. Until now, about 10,000 t of the uranium supply of about 20,000 t have been mined. About 400-800 t, i.e., 2 to 4% of the whole uranium supply, have been depleted. The specimen showing the highest deviation had 0.296% U-235 as compared to 0.72% in normal natural uranium, the mean deviation in the region of natural reactors being, however, no more than about 0.62% of U-235. The Oklo mine had values of up to 60% uranium or up to 80% UO_2; a natural fission chain reaction requires about 50% uranium and 25% water as a neutron moderator. The natural reactors had a thickness of 0.6 to 1 m and a width of a few meters. (DE)

14824 ABUNDANCE AND DISTRIBUTION OF URANIUM IN SOME OCEANIC, CONTINENTAL ULTRAMAFIC INCLUSIONS, AND HOST BASALTS. Hamilton, E. I. Chem. Geol.; 16: No. 3, 221-231(Nov 1975).

The abundance and distribution of uranium in various continental and oceanic ultramafic inclusions and host basalts are reported. Uranium was determined by neutron activation (fission products, fission tracks and delayed-neutron methods) and alpha-particle autoradiography; data is also reported for the uranium content of various USGS standard rock powders. The concentration of uranium in both oceanic and continental samples is similar, levels are controlled by mineral compositions and their relative abundance in different rock types. Highest levels are found in feldspathic and lowest in olvine-rich inclusions. Uranium is enriched in mylonitized samples and along some inter-crystal boundaries. With the exception of some apatites, highest levels of uranium are in clinopyroxenes (chrome) and lowest in olivines; no enrichment of uranium in orthopyroxenes was observed. Attention is drawn to the problem of obtaining representative samples from the sea floor which have not been altered by saline solutions and the identification of uranium and daughter products present along inter-crystal boundaries. Differences in observed heat flow between continental and oceanic areas may reflect inadequate sampling of representative rock types present below the sea floor and lack of information for the true abundance and distribution of uranium in such rocks. (NL)

Radioactivity Monitoring and Transport

Refer also to abstract 15100.

14825 (FRNC-R-036) INTERNATIONAL LEGISLATION RELATIVE TO NUCLEAR POLLUTION OF THE OCEANS. Birot, C. (Conservatoire National des Arts et Metiers (CNAM), 75- Paris (France). Inst. National des Techniques de la Documentation). 1973. 31p. (In French). INIS.

The part played by various competent international bodies in the establishment of international rules concerning the nuclear pollution of oceans is analyzed. As it stands this legislation distinguishes clearly between pollution caused by peaceful and military uses of nuclear energy. In studying the former type of pollution the problems of radioactive wastes, sea transport of radioactive substances, ships propelled by nuclear energy and isotopic generators in a marine environment are considered in turn. From the military viewpoint the legislation seems more complicated and the problems are of two kinds: that of nuclear armaments in a marine environment and the consequent risks, and that of fallout from experimental atmospheric explosions carried out in peacetime but for military purposes. (FR)

14826 (IFTJ-73/I) PROPOSAL OF THE MATHEMATICAL MODEL OF THE AQUIFER FOR INTERPRETATION OF MEASUREMENTS OF NATURAL ISOTOPES IN THE WATER. Nawalany, M. (Institute of Physics and Nuclear Techniques, Krakow (Poland)). 1975. 76p. (In Polish). Dep. NTIS (US Sales Only) $4.50.

Mathematical models for use in isotope hydrology are presented. The most commonly used deterministic models are discussed, including the piston flow and good mixing models. The model of non-ideal mixing is introduced into the hydrological considerations. This model is a generalization of the good mixing model and allows for different processes of mixing of natural isotopes in waters of hydrological systems. The most important stochastic model, i.e., the dispersive model is also discussed. A three-velocity model is proposed that differs from the other models in following properties: it includes finite flow velocity of the tracer particles; it takes into account the presence of stagnant water; it satisfies the law of fluid continuity; and it is convergent to the piston-flow model in limit. (auth)

14827 (INR-1473/19/D/B) TERRESTIAL γ RADIATION FIELD IN THE LOWER ATMOSPHERE AND METHOD OF ITS INVESTIGATION. Pensko, J. (Institute of Nuclear Research, Warsaw (Poland)). 1973. 239p. (In Polish). INIS.

In this report the natural radiation sources widely dispersed in our environment as well as the γ radiation field in the lower layer of the atmosphere are described. The migration mechanism of radon isotopes in soil and rocks is discussed and also its influence on the properties of the natural γ radiation field above the soil surface is considered. The energy and angular response of some radiation detectors suitable for the measurements of natural γ radiation background were investigated. Their sensitivity on natural β radiation and cosmic radiation was estimated. Several methods elaborated and used by the author for investigation of natural γ background radiation are described. The method of population dose assessment from natural background radiation as the base for the hazard control of the inhabitants living in the environment of nuclear installations is presented. (auth)

Atmosphere

Refer also to abstracts 14362, 14877, and 15100.

14828 (IEA-31) ENVIRONMENTAL IMPACTS OF NUCLEAR POWER PLANTS. Kikuchi, C. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Sep 1974. 126p. Dep. NTIS (US Sales Only) $6.00.

The publication is based on a series of seminars given at the Instituto de Energia Atomica. Some topics discussed are: development of new technologies using nuclear power; national environmental policy act; energy needs versus energy consumption; health physics of overdose radiation; natural radioactivity in the environment; radiation monitoring; radiation doses; solar energy; radioactive wastes; coal versus nuclear power plants; atmospheric transport mechanisms; and pathways of ^{131}I to man. (HLW)

14829 (PB-238772) ANNUAL CONFERENCE ON BIOASSAY (20th), ENVIRONMENTAL, AND ANALYTICAL CHEMISTRY HELD AT STOUFFER'S INN, CINCINNATI, OHIO, ON 24-25 SEPTEMBER 1974. Program Abstracts. (National Environmental Research Center, Cincinnati, Ohio (USA)). Jan 1975. 52p. (CONF-7409141-(Absts.)). NTIS $4.25.

From 20th annual conference on bioassay, environmental, and analytical chemistry; Cincinnati, Ohio, United States of America (USA) (24 Sep 1974).

This volume contains abstracts of the 20th Annual Conference on Bioassay, Environmental, and Ananlytical Chemistry whose subject matter included measurement, determination, and analysis for radioactivity in the environment, animals, and man. The presentations concerned techniques, methods, instruments, etc., for determining a variety of radioactive substances (e.g., iodine, uranium, americium) in a variety of situations (reactor stack gases, soil, body tissue, occupational working areas). (GRA)

14830 (PB-239191) SUMMARY OF RADIOACTIVITY RELEASED IN EFFLUENTS FROM NUCLEAR POWER PLANTS DURING 1973. (USAEC Office of Operations Evaluation, Washington, D. C.). Jan 1975. 53p. (OOE-OS-003). NTIS $4.25.

Releases of radioactivity in airborne and liquid effluents and the number of shipments and activity of solid waste have been compiled from licensee reports for 1973. There were wide variations in radioactive releases due to differences in plant size, power level, fuel performance, and effluent treatment methods. Data covering specific isotopes of particular interest have been summarized. In all cases, releases of radioactivity were only small fractions of permissible limits set by applicable regulations or in technical specifications. (GRA)

14831 (REG/G-4.9(Rev.1)(10-75)) PREPARATION OF ENVIRONMENTAL REPORTS FOR COMMERCIAL URANIUM ENRICHMENT FACILITIES. (Nuclear Regulatory Commission, Washington, D.C. (USA). Office of Standards Development). Oct 1975. 32p. NUREG.

The guide was prepared to provide assistance to applicants for the development of environmental reports dealing with the construction, operation, and decommissioning of uranium enrichment facilities. Nine chapters discuss the following topics: proposed activities; the site; the plant; environmental effects of site preparation, plant construction, and operation; environmental effects of accidents; effluent and environmental measurements and monitoring programs; plant siting and design alternatives; benefit cost analysis; and environmental approvals and consultations. (HLW)

14832 (SCPRI(RM)-4-75) REPORT OF ACTIVITIES, APRIL 1975. (Service Central de Protection Contre les Rayonnements Ionisants, 78-Le Vesinet (France)). Apr 1975. 16p. (In French). Dep. NTIS (US Sales Only) $3.50.

Data on environmental radioactivity for April, 1975, are presented for the following: ^{7}Be, ^{90}Sr, ^{95}Zr, ^{95}Nb, ^{103}Ru, ^{106}Ru, ^{125}Sb, ^{131}I, ^{137}Cs, ^{140}Ba, ^{140}La, ^{141}Ce, ^{144}Ce, and ^{144}Pr. The following environmental samples were monitored at various locations in France: atmospheric dusts at ground level and at high altitudes, rain water, surface water, ground water, food, irrigation water, drinking water, and seawater. (HLW)

14833 (SCPRI(RM)-4-1975(APP.)) APPENDIX TO THE MONTHLY PROGRESS REPORT. Details of the Results of Measurements. (Service Central de Protection Contre les Rayonnements Ionisants, 78- Le Vesinet (France)). Apr 1975. 21p. (In French). INIS.

Measurement tables concerning the surveillance of the environment are presented. (see also the SCPRI-RM-4-1975 report). (FR)

14834 (TID-25650-S1) SELECTED BIBLIOGRAPHY OF TERRESTRIAL FRESHWATER, AND MARINE RADIATION ECOLOGY. Schultz, V.; Whicker, F. W. (Washington State Univ., Pullman (USA). Dept. of Zoology; Colorado State Univ., Fort Collins (USA). Dept. of Radiology and Radiation Biology). 1975. 244p. Dep. NTIS $7.60.

An extensive bibliography is presented of publications related to field or laboratory studies of wild species of plants and animals with respect to radiation effects or metabolic studies involving radionuclides. The references are listed under the following headings: status and needs of radiation ecology; environmental radioactivity; radionuclide concentration; ionizing radiation effects; techniques utilizing radionuclides and ionizing radiation in ecology; measurement of ionizing radiation; peaceful uses of atomic energy; waste disposal; nuclear testing and ecological consequences of a nuclear war; glossaries, standards, and licensing procedures; reviews of radionuclides in the environment; and sources of information. (HLW)

14835 (UCRL-51625-75) PROGRESS IN RAINOUT RESEARCH AT LAWRENCE LIVERMORE LABORATORY: FISCAL 1975. Knox, J. B.; Molenkamp, C. R.; Harvey, T. F.; Peterson, K. R.; Barbieri, J. F.; Lange, R.; Fulk, M. M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Sep 1975. Contract W-7405-eng-48. 103p. Dep. NTIS $5.50.

The collateral damage that can result from the precipitation scavenging of nuclear aerosols produced by low-yield nuclear explosions was investigated. The status of the scientific understanding necessary to make estimates of rainout-produced radiation fields, the development of models and methodologies for rainout assessments, and attempts at removing uncertainties from these models and assessment results are discussed. (CH)

14836 NUCLEAR SAFETY AND THE ENVIRONMENT. Evidence by the Department of Energy to the Royal Commission on Environmental Pollution in Connection with its Study of Radiological Safety. London; Department of Energy (1975). 38p.

It is hoped that the publication of the evidence will contribute to informed opinion and assist the development of balanced views in the continuing debate about nuclear power and its place in the nation's energy supplies. A note sets out energy demand and supply considerations which need to be taken into account in relating energy and environmental policies. Specific questions posed by the commission are dealt with in annexed notes entitled; energy and electricity demand forecasts to 2000, consideration of environmental issues in energy policy formulation, prospects for using renewable energy resources, prospects for nuclear fusion, the fast reactor in United Kingdom energy policy, the role of the department of energy in nuclear safety, the allocation of R and D resources on the various energy options, energy accounting and nuclear power; and adequacy of information for public debate on nuclear power. (UK)

14837 METHOD AND EQUIPMENT FOR STUDYING THE ELECTRIC CHARGING OF β-ACTIVE HOT AEROSOL PARTICLES. Ivanov, V. D.; Kirichenko, V. N.; Shan'gin, B. V.; Berezhnoy, V. M. (Physical Chemistry Inst., Moscow). Kolloid, Zh.; 36: No. 3, 468-472(1974). (In Russian).

A method was developed whereby the characteristic time parameter of charging of hot β-active aerosol particles can be determined and the effects on this parameter of the energy of electrons emitted by the particles, the rate of sedimentation, the external electric field, and the composition and state of the surrounding gas can be studied. The parameter of charging was calculated on the basis of oscillographic data recorded until a stationary point was reached at which the potential of a unipolar pulse current that was applied between two electrodes in an ultramicroscopic arrangement suspended a single particle (a spherical glass particle with a radius of 1.5-2 μm that had been labelled with ^{192}Ir) in a state of vibration i.e., until the sedimentation velocity of the particle was counteracted. At sufficiently high electric pulse frequencies the characteristic time of charging approached that which would be required by the particle for acquiring a stationary charge in the absence of an external electric field. Under practical experimental conditions in which the particle was too heavy to be suspended, the velocity of sedimentation was replaced by the equivalent velocity of the relative motion of charged ions upon application of a weak constant electric field. (JPRS)

14838 REPORT OF BOARD II: RADIOACTIVE FALLOUT. Schumann, G. pp 47-55 of Progress Report of the Safety Commission of the Federal Ministry of the Interior for the Year 1973. Bonn, F. R. Germany; BMI (1973). (In German)

The board worked the problems of radioactive contaminations in the atmosphere, the ground, the groundwater, and in drinking water treatment plants with the aim of providing the necessary data for a quick and detailed assessment of the danger by civil guards in cases of nuclear disaster. In addition of measurements of the concentration of radioactive sources in the atmosphere, in precipitations, in the ground, and in the water, some knowledge of meteorological data and parameters is necessary for an estimation of the development of the danger in time and space. Dosimetrical problems are also included. (DE)

14839 A METHOD FOR MEASUREMENT OF THE KRYPTON-85-CONTENT IN THE ATMOSPHERE. Stockburger, H.; Sittkus, A. (Max-Planck-Institut fuer Kernphysik, Freiburg im Breisgau (F. R. Germany)). Z. Naturforsch., A; 30: No. 8, 959-961(Aug 1975). (In German)

1 fig.; 1 tab.; 7 refs.

To measure the Kr-85 content in the atmosphere we developed a simple method. Within a time interval of five to ten days (depending on the moisture of the air) five to ten m^3 of air (NTP) are pumped through activated carbon (Pressure 300 torr, temperature 77 K). When sampling time is over, the carbon is heated to 470 K. This gives a gas sample of 4 l with more than 90% of the atmospherical krypton in 3 hours. With a further step of enrichment, the volume of the sample is reduced to 100 ml. The final separation of krypton from O_2, N_2, CO, CO_2, and Xe is made by gaschromatography at room temperature with methane as eluent gas (duration 25 min). The Kr-fraction is transported to a proportional counter (200 ml). The overall yield is 90%. The overall error of the Kr-85 content is near 1%. Data are given for the time of 15.6.1973 to 29.12.1974. (DE)

14840 RADIATION MONITORING OF GASEOUS AND LIQUID RADIOACTIVE WASTES. Jagersberger, H. (Kraftwerk Union A. G., Offenbach (F. R. Germany)); Kuhn, L. (Kraftwerk Union A. G., Erlangen (F. R. Germany)). Arch. Tech. Mess. Messtech. Prax.; 472: 71-73(May 1975). (In German)

3 figs.; 10 refs.

Nuclear power plants are in principle (radiologically seen) closed systems. The necessary release of radioactive substances for operation given off to the environment is permissible to a legal extent and in a thus controllable manner. There are two release openings: the chimney and the waste water release pipe

or cooling water drain channel. Both places must be suitably controlled. (DE)

14841 CUMULATIVE FALLOUT AND GROWING-OLD INDEXES FOR 1970–1973. Usacev, S. (Komenskeho Univ., Bratislava). Acta Fac. Rerum Nat. Univ. Comenianae, Phys.; 15: 165-168(1975). (In Czech)

The results of radioactive fallout measurements from rain samples collected during 1970 to 1973 are presented. These results present continuing study of radioactive fallout measurements performed at the Department of Nuclear Physics from 1958. Simultaneously growing-old indexes obtained from 500 samples are presented. (auth)

Soil

Refer also to abstracts 15368 and 15522.

Water

Refer also to abstract 14869.

14842 QUALITY OF WATER IN WILSON AND PICKWICK RESERVOIRS. Chattanooga; Tennessee Valley Authority (1974). 97p.

The bacteriological, sanitary-chemical, mineral, and radiological qualities of water flowing into and through Wilson and Pickwick reservoirs were determined from results of an intensive 12-mo water quality survey from May 1965 through Apr. 1966. The bacteriological quality was impaired downstream from Wilson Dam by the addition of municipal and industrial wastes from the cities of Florence, Sheffield, Muscle Shoals, and Tuscumbia. The area was classified unsuitable for water-contact recreation because TVA fecal coliform criteria were exceeded. The main stream areas on Pickwick Reservoir were suitable for all recreational uses, and the bacteriological quality of water from all of the sampling locations, except 1 on Yellow Creek embayment, was satisfactory to excellent. Radioactivity, color, odor, and organic contents of the reservoir waters were low. Water hardness was soft to moderately hard. (Pollut. Abstr.)

14843 KRYPTON-85 IN THE OCEAN. Schroeder, J. (Heidelberg Univ. (F. R. Germany). Inst. fuer Umweltphysik). Z. Naturforsch., A; 30: No. 8, 962-967(Aug 1975).

5 figs.; 1 tab.; 33 refs.

A method is described to determine for the first time the ^{85}Kr concentration in seawater. Samples of 220 l of seawater are degassed aboard a research vessel. The krypton contained in the gas sample is isolated in the laboratory and its ^{85}Kr activity is measured in a gas counter. The background of the low-level counting-array is 0.026 cpm; surface water samples yield a net countrate of 0.13 cpm. The reproducibility of the method was checked by gas standards (krypton-air mixtures) and moreover by three surface water samples; both sets agree within $\pm 1\ \sigma$, or $\pm 5\%$. The mean value of three samples of great depths (1,600, 2,000, 2,000 m) is 5% of the surface water concentration. This figure represents the possible contamination of the samples by atmospheric ^{85}Kr during the various preparation stages (blank value). Two profiles have been measured from the North Atlantic (about 40°N, 18°W, November 1972). A strong decrease of the ^{85}Kr concentration is found in the upper 1,000 m. In a simple one-dimensional vertical diffusion-advection model the profiles can be simulated with a coefficient of apparent vertical eddy diffusion of 5 cm^2/sec in the depth range of 300 to 1,000 m (main thermocline). A possible application of oceanic ^{85}Kr data is the combination of depth profiles with those of other tracers, in particular ^{3}H. Another application of the ^{85}Kr method is the dating of groundwaters younger than 20 years. (DE)

14844 BOMB TRITIUM IN THE PACIFIC OCEAN. Michel, R.L.; Suess, H.E. (Department of Chemistry, University of California, San Diego, La Jolla, California 92037). J. Geophys. Res. 80: No. 30, 4139-4152 (20 Oct 1975).

During the period 1959–1973 the La Jolla Tritium Laboratory monitored bomb-produced tritium in surface seawater from 15 stations in the Pacific Ocean. Some 500 tritium determinations were carried out during this time. Furthermore, between 1965 and 1972 a series of subsurface samples from 49 locations in the Pacific Ocean was measured, and tritium concentrations as a function of depth were determined. The determinations had a standard error of ±4% and an uncertainty in the zero value of about 0.17 tritium unit. The most significant oceanographic conclusions that must be drawn from these data can be summarized in the following way: (1) Lateral flow along contours of constant density is the major factor controlling the tritium distribution in the surface and subsurface waters of the Pacific Ocean. Input of tritium into the water below the mixed layer occurs between 45° and 30°N and south of 60°S. The sinking of water in the mid-Pacific at 30°N and its flow toward the equator was previously recognized from the presence of a salinity maximum below the thermocline. Our tritium measurements allow us now to estimate the southward component of the rate of this flow to be 1.3±0.5 cm/s. In many other areas the tritium content of water under the mixed layer is undoubtedly also due to local sinking of surface water and subsequent lateral subsurface flow. (2) An upper limit for the coefficient of vertical eddy diffusion can be calculated from our tritium data in the eastern North Pacific gyre. This upper limit of 0.3 cm^2/s is well below estimates derived by most other methods (Veronis, 1969), but it agrees well with the upper limit of 0.2 cm^2/s derived by Rooth and Östlund (1972) from tritium measurements in the Sargasso Sea. Thus it appears that transport across lines of constant density is much slower than previously assumed. (3) The mean lifetime of water in the mixed layer of the North Pacific Ocean, i.e., the residence time, varies greatly with geographical location. North of 10°N the average residence time is between 9 and 15 years, depending on the assumed rate of the molecular exchange of water between atmosphere and ocean. (auth)

Ecosystems and Food Cycles

Refer also to abstract 15083.

14845 (EDFB-IBP-74-2) INTERACTIVE DIFFERENTIAL EQUATIONS MODELING PROGRAM. Rust, B. W.; Mankin, J. B. (Oak Ridge National Lab., Tenn. (USA)). Jan 1976. Contract W-7405-eng-26. 121p. Dep. NTIS $7.00.

Due to the recent emphasis on mathematical modeling, many ecologists are using mathematics and computers more than ever, and engineers, mathematicians and physical scientists are now included in ecological projects. However, the individual ecologist, with intuitive knowledge of the system, still requires the means to critically examine and adjust system models. An interactive program was developed with the primary goal of allowing an ecologist with minimal experience in either mathematics or computers to develop a system model. It has also been used successfully by systems ecologists, engineers, and mathematicians. This program was written in FORTRAN for the DEC PDP-10, a remote terminal system at Oak Ridge National Laboratory. However, with relatively minor modifications, it can be implemented on any remote terminal system with a FORTRAN IV compiler, or equivalent. This program may be used to simulate any phenomenon which can be described as a system of ordinary differential equations. The program allows the user to interactively change system parameters and/or initial conditions, to interactively select a set of variables to be plotted, and to model discontinuities in the state variables and/or their derivatives. One of the most useful features to the non-computer specialist is the ability to interactively address the system parameters by name and to interactively adjust their values between simulations. These and other features are described in greater detail. (auth)

14846 SYSTEMS IDENTIFICATION: A THEORETICAL METHOD APPLIED TO TRACER KINETICS IN AQUATIC MICROCOSMS. Halfon, E. (Univ. of Georgia, Athens). pp 262-265 of Structure, Functioning, and Management of Ecosystems. Wageningen, Netherlands; PUDOC (1974).

From 1st international congress of ecology; The Hague, Netherlands (8 Sep 1974).

A mathematical model of radionuclide kinetics in a laboratory microcosm was built and the transfer parameters estimated by multiple regression and system identification techniques. Insight into the functioning of the system was obtained from analysis of the model. Methods employed have allowed movements of radioisotopes not directly observable in the experimental systems to be distinguished. Results are generalized to whole ecosystems. (NL)

14847 RECORDS OF PLUTONIUM FALLOUT IN MARINE AND TERRESTRIAL SAMPLES. Koide, M.; Griffin, J.J.; Goldberg, E.D. (Scripps Institution of Oceanography, La Jolla, California 92037). J. Geophys. Res. 80: No. 30, 4153-4162 (20 Oct 1975).

In coastal marine sediments from western North America there is a continuing increase in $^{239+240}Pu$ concentrations from the early 1950's to the present. Most of these transuranic isotopes have entered our surroundings following nuclear weapons testing from direct stratospheric fallout which went through a maximum around 1963. Since no maximum level in the sediments corresponding to the maximum stratospheric fallout was observed, another source of plutonium to these deposits was sought. It has been identified through the analyses of atmospheric aerosols as crustal rock debris transferred from the continents to the oceans by winds. A transport of soil debris, containing sorbed artifical radionuclides, to the oceans by winds and/or by rivers may explain the greater ^{90}Sr fluxes to the marine environment, compared to those of the continents, after this fission product in nuclear explosions. (auth)

Radiometric Techniques

Refer also to abstract 14234 and 14961.

14848 (COO-1771-6) NUTRIENT CYCLING AND PRODUCTIVITY OF DYSTROPHIC LAKE-BOG SYSTEMS (PART A). Technical Progress Report, December 1, 1972-September 30, 1975. Hooper, F. F. (Michigan Univ., Ann Arbor (USA)). Oct 1975. Contract AT(11-1)-1771. 59p. Dep. NTIS $5.50.

A sampler and an analytical and characterization scheme were developed to investigate the chemical and physical state of iron in a highly stained acid bog lake. Iron fractions were chemically separated by reactivity to bathophenanthroline (BPN) after specific digestion procedures. Physical separation involved anaerobic in situ filtration (450 nm), and in situ dialysis (4.8 nm). This resulted in three size classes: particulate, colloidal, and dissolved. Unlike pH 6-8 lakes, inorganic, nonreactive species of iron [e.g., $Fe(OH)_3$] represent minor amounts of the total iron in North Gate Lake. In situ radiochemical analyses revealed that colloidal sized reactive ferric iron predominates in the oxygenated epilimnion, while dialyzable or dissolved ferrous iron increases with depth. Unlike iron, organic matter is present in a nontransient colloidal state. In acid (pH 4-5) bog lakes ferric iron is not colloidal as an inorganic complex (OH^-), but colloidal as reactive Fe^{+3} by complexation with the colloidal organic acids. After thermally induced mixing with anaerobic waters, ferric iron is reduced and dissolved. However, some of the BPN reactive iron remains colloidal suggesting the presence of a residual ferrous organic complex. (auth)

14849 ELECTRONIC DATA PROCESSING AND RADIOMETRIC AGE DETERMINATIONS. Lenz, H. (Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover (F. R. Germany)). Geol. Jahrb., Reihe C; No. 1, 75-80(1973). (In German)

4 figs.

It is demonstrated by an Rb/Sr age determination how to use electronic data processing in order to get mass spectrometric isotope analyses for radiometric age determinations. By a digital recording of the ionic current intensities and of the other necessary measuring data, and by the further processing with the help of a computer, an increase of the accuracy of the measurements could be achieved and the evaluation process be speeded up. (DE)

14850 THE APPLICATION OF THE ^{14}C AND ^{3}H METHODS FOR ENVIRONMENTAL STUDIES IN HYDROLOGY. Geyh, M. A. (Niedersaechsisches Landesamt fuer Bodenforschung, Hannover (F. R. Germany)). Z. Dtsch. Geol. Ges.; 124: 515-522(1973). (In German)

2 figs.; 1 tab.; 15 refs.

The applicability of the ^{14}C and ^{3}H methods for environmental studies in hydrology is demonstrated. Examples are the determination of the seepage velocity of the precipitation, the estimation of the mean residence time of spring waters, water budgeting, hydrodynamic studies in aquifers and the investigation of organic pollutions in rivers. (DE)

14851 AGE DETERMINATION OF DEEP-SEA SEDIMENTS. Heye, D. (Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover (F.R. Germany)). Umsch. Wiss. Tech.; 75: No. 16, 512(Aug 1975). (In German).

3 refs.

During the last ten years deep-sea sediment cores have been studied in the Bundesanstalt fuer Geowissenschaften und Rohstoffe in order to determine the sedimentation rate by paleomagnetic reversals and ^{230}Th age determination. A method for paleomagnetic measurements of sediment cores abroad a ship has been developed. (DE)

14852 EXCESS OF ATMOSPHERIC NEON IN PUMICE FROM THE ISLANDS OF LIPARI. Bochsler, P.; Mazor, E. (Weizmann Inst. of Science, Rehovoth, Israel). Nature (London); 257: No. 5526, 474-475(9 Oct 1975).

It is stated that as a search for primordial gases in terrestrial rocks is important in connection with an understanding of the formation and thermal history of the Earth it was decided to examine the isotopic composition of the Ne in pumice from the Lipari Islands. It is noted that Lord Rayleigh in 1939 had reported an excess of Ne over Ar in this material. It is also noted that Dymond and Hogan in 1973 also reported excesses of Ne in mid-oceanic tholeiitic basalts and suggested that they indicate primordial Ne. In all the samples examined significant excesses of Ne were observed, the $^{20}Ne/^{36}Ar$ ratio reaching the value of 15.8, compared with the atmospheric value of 0.52. The excess Ne showed $^{20}Ne/^{22}Ne$ and $^{22}Ne/^{21}Ne$ values indistinguishable from atmospheric ratios. The data seem to indicate that the excess Ne is of atmospheric origin. The mechanism whereby the pumice takes up Ne on its formation needs further study. (UK)

14853 ISOTOPIC ANALYSIS OF SULFATE IN A SOUTH PACIFIC CORE. Cortecci, G. (Univ., Pisa, Italy). Mar Geol.; 19: No. 5, M69-M74(Nov 1975).

The sulfur-34 isotope profile of sulfate in a red-clay sediment gravity core 120 cm long from the South Pacific indicates a very weak, if any, bacterial sulfate-reducing activity. This activity is not shown by the oxygen-18 distribution. The sulfur and oxygen isotopic values are close to those of the overlying seawater sulfate and to the average oceanic values. Of all the parameters mainly able to affect the bacterial activity, such as temperature, molecular oxygen and organic matter, the very small concentration of organic matter seems to be responsible for the almost total lack of sulfate reduction. (NL)

14854 ISOTOPIC FRACTIONATION OF DISSOLVED NITRATE DURING DENITRIFICATION IN THE EASTERN TROPICAL NORTH PACIFIC OCEAN. Cline, J. D.; Kaplan, I. R. (Univ. of California, Los Angeles). Mar. Chem.; 3: No. 4, 271-299 (Nov 1975).

The isotopic composition ($\delta^{15}N$) of dissolved nitrate was measured at five stations within the oxygen-deficient region of the eastern tropical North Pacific Ocean (ETNP) and at one station 900 km northeast of Hawaii which was considered to be representative of all major water masses of the Pacific. At this last station, the $\delta^{15}N$ composition of dissolved nitrate decreased systematically from about 0.6‰ at 400 m to approximately 0.5‰ at 5,000 m; these results are consistent with other estimates from the western Pacific. In contrast, vertical profiles of $\delta^{15}N$ of dissolved nitrate from the ETNP showed a marked departure from the above observed trend and correlated with losses of nitrate arising from denitrification. Instantaneous fractionation factors (α) were estimated using the one dimensional vertical diffusion-advection model. These results suggest that $^{14}NO_3^-$ is consumed 3-4‰ faster than $^{15}NO_3^-$, significantly larger than fractionations (≤2‰) observed under laboratory conditions. Maximum rates of denitrification at 100m were also evaluated and ranged from 0.6 to 8 μg-atl^{-1} yr^{-1} for the stations investigated. The above upper limit is probably excessive, but the average maximum for the four stations analyzed is estimated to be 3.5 μg-at NO_3^--l^{-1}-yr^{-1}. These results compare favorably with suitably corrected oxygen utilization rates derived from electron transport activity measurements. (NL)

14855 GEOCHEMISTRY AND NATURAL IONIC AND ISOTOPIC TRACING; TWO COMPLEMENTARY WAYS TO STUDY THE NATURAL SALINITY REGIME OF THE HYDROLOGICAL SYSTEM OF LAKE CHAD. Roche, M. A. (ORSTOM, Paris). J. Hydrol.; 26: No. 1-2, 153-171(Jul 1975).

As a consequence of intense evaporation and transit through a succession of sedimentary traps (flood plains, lake, dune aquifer and interdune depressions), the isotopic composition of the water and the characteristics of the dissolved and suspended loads change downstream in a regular manner resembling chromatography. The migration of the water and chemical constituents, from one end to the other of this endorheic basin extending from the humid tropics to the desert margins, is outlined and quantified. The erosion, transport and sedimentation phenomena, and the natural saline and isotope tracing methods are studied simultaneously. The isotopic composition of the waters shows a large contribution (300 mm/year) to the groundwater by rain falling on the dunes which border the lake. The lake water infiltrates into the banks and is then partially lost by evaporation. The dissolved substances are taken up again by the rains on the banks. Major floods at intervals of several years also evacuate some of the dissolved salts from the vicinity of the lake towards the land bordering it. In the interdune depressions, these solutes give rise to evaporite parageneses where trona is predominant. (NL)

Site Surveys

14856 (BNWL-B-448) HEAT SINK MANAGEMENT FOR A HANFORD NUCLEAR ENERGY CENTER. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Nov 1975. Contract E(45-1)-1830. 43p. Dep. NTIS $5.45.

An interim account is given of the work being performed to develop a heat sink management plan for the conceptual study of a Hanford Nuclear Energy Center (HNEC). Primary attention has been focused on the tentative selection of sites for HNEC reactor plants and cooling system facilities. The locations of the sites must be taken into consideration when making choices between alternate cooling systems for a heat sink management plan. Ten reactor plant sites have been tentatively selected, each of which is potentially suitable for accommodating a cluster of at least four 1300 MWe units. Three sites, two of which are north of the Columbia River, have been tentatively selected for cooling lakes, and a potential route through the Hanford Reservation has been identified

for a cooling canal. The criteria used in the site selection process and the locations of the sites and some of the geologic characteristics of the sites are discussed. The literature has been surveyed pertaining to the physical characteristics of the Columbia River, the standards governing permissible increases in river temperature due to thermal discharges, and the results of investigations that have been performed to assess the impacts of the Hanford plutonium production reactors which, until recently, discharged significant quantities of heated effluents to the Columbia River. (auth)

Thermal Effluents

Refer also to abstract 14814.

14857 HEATED WATER JET IN COFLOWING TURBULENT STREAM. Shirazi, M. A. (National Environmental Research Center, Corvallis, OR); McQuivey, R. S.; Keefer, T. N. J. Hydraul. Div., Am. Soc. Civ. Eng.; 100: No. HY7, 919-934 (Jul 1974).

Effects of ambient turbulence on temperature and salinity distributions of heated water and neutrally buoyant saltwater jets were studied for a wide range of densimetric jet Froude numbers, jet discharge velocities, and ambient turbulence levels in a 4-ft-wide channel. Estimates of vertical and lateral diffusivity coefficients for heat and for salt were obtained from salinity and temperature distributions taken at several stations downstream of the injection point. Readily usable correlations are presented for plume center-line temperature, plume width, and trajectory. The ambient turbulence affects the gross behavior characteristics of the plume. The effects vary with the initial jet Froude number and the jet to ambient velocity ratio. Heat and salinity are transported similarly and the finite source dimensions and the initial jet characteristics alter the numerical value of the diffusivity. (Pollut. Abstr.)

14858 EFFECT OF STREAM TURBULENCE ON HEATED WATER PLUMES. Weil, J.; Fisher, H. B. J. Hydraul. Div. Am. Soc. Civ. Eng.; 100: No. HY7, 951-970 (Jul 1974).

A heated water surface jet flowing at the mean local velocity in open channel flow is studied. The jet contains no excess momentum that can cause mixing by relative motion of parallel streams. Buoyancy and ambient flow turbulence determine downstream behavior. Dimensional analysis determines the independent variables: a distance ratio, a depth ratio, a friction factor, and a densimetric Froude number. Axis temperature is independent of depth ratio and Froude number, and only weakly dependent on friction factor. Results are given for temperature vs. depth ratio. Mixing is significant, but dilution is less than for momentum jets in still water. Plume width and layer depth are described. Results for layer depth are shown vs. distance ratio and are largely independent-of-depth ratio, friction factor, and densimetric Froude number. (Pollut. Abstr.)

14859 DEMONSTRATION OF THERMAL WATER UTILIZATION IN AGRICULTURE. Berry, J. W.; Miller, H. H. Jr. Washington, DC; Environmental Protection Agency (1974). 265p.

A 5-yr demonstration project was conducted to determine benefits and identify harmful effects of using waste heat in condenser cooling water (90^0F-110^0F) for agricultural purposes. Initial phases emphasized use and evaluation of warm water for spring frost protection, irrigation, and plant cooling in summer. Row crops, and fruit and nut trees were used in the evaluation. Undersoil heating was demonstrated on a 1.2-acre soil plot. Two and one half inch plastic pipes were buried 26 in deep and 5 ft on center, connecting to 6-in. steel headers. Warm water was circulated through the grid, heating soil on which row crops were grown. Crop production was evaluated in a 22 x 55-ft plastic greenhouse constructed on a portion of the undersoil heat grid. The greatest potential benefit of waste heat use in agriculture is in the area of greenhouse soil heating. Monetary benefits from industrial waste heat appear achievable through proper management. (Pollut. Abstr.)

14860 STUDIES OF A HEATED, TURBULENT JET IN A SHALLOW, BOUNDED WATERWAY. Sill, B. L.; Schetz, J. A. Blacksburg, VA; Virginia Polytechnic Institute and State University (1973). 249p.

Photographic, flow visualization, velocity, and temperature measurements were used to study effects encountered when a heated jet is discharged into a mainstream. A mathematical analysis of this process included boundedness, buoyancy, and turbulent mixing. The following primary conclusions were drawn: Free stream velocity decreases with jet injection. Recirculation regions can form in the free stream. The bounding wall has a noticeable damping effect on jet spread. The jet may separate from the near wall for certain heated injections. Buoyant jets have a greater effect on the free stream than isothermal jets. (Pollut. Abstr.)

14861 WINTER-REGIME SURFACE HEAT LOSS FROM HEATED STREAMS. Paily, P. P.; Macagno, E. O.; Kennedy, J. F. Iowa City, IA; University of Iowa (1974). 152p.

Evaluation of the rate of surface heat exchange between the water and air is a significant factor in any study of the thermal response of heated streams to heat inputs. Existing methods to determine the amount of heat transfer across the water surface are surveyed, and the different formulas developed for determining the heat exchange components are compiled. Heat-transfer models that have been proposed in the literature are reviewed, and a new linearized model for determining the rate of surface heat exchange is proposed. Generalized relations between the major climatological factors and the coefficients of the linearized heat-loss rate are established by multiple-regression analysis. The analysis is limited to cold-period conditions, in the sense that air temperatures below the freezing point of water only are considered in developing the regression equations. A computer program, using FORTRAN, is presented which enables the computation of the coefficients appearing in the linearized heat-loss rate for all combinations of the various climatological factors. (Pollut. Abstr.)

14862 WINTER REGIME PERFORMANCE OF COOLING WATER DISCHARGE STRUCTURE, ZION NUCLEAR PLANT, LAKE MICHIGAN. Tatinclaux, J. C.; Jain, S. C.; Pena, J. M.; Kennedy, J. F. Iowa City, IA; University of Iowa (1974). 63p.

A Zion Nuclear Station discharge structure was studied to determine effluent plume behavior under winter conditions. A deeply submerged undistorted model of the structure and a distorted model, in which the ratio of depth of submergence: structure ht was equal to the prototype ratio of 4, were tested. Ambient flow temperature remained at 32.2^0F and effluent temperature at 52.2^0F. Initial effluent mixing with ambient flow was greater with the distorted model. Several values of the ratio K of initial jet velocity: ambient flow velocity were also investigated. In all cases a sinking plume formed, with highest temperatures recorded along the flume bottom. Excess temperatures of greater than or equal to 15 percent were measured at the downstream end of the flume and a similar temperature excess is to be expected near the plant discharge over an area of Lake Michigan's bed larger under calm, winter conditions than that occupied by the summer surface plume. (Pollut. Abstr.)

14863 THERMAL RESPONSE OF HEATED STREAMS, SOLUTION BY THE IMPLICIT METHOD. Paily, P. P.; Macagno, E. O. Iowa City, IA; University of Iowa (1974). 78p.

The thermal response of natural streams to artificial heat inputs from thermal power stations is mathematically represented by the 1-dimensional convection-diffusion equation for fully mixed flow conditions. The unsteady 1-dimensional convection-diffusion equation is a nonlinear parabolic partial differential equation, due to the presence of the surface heat exchange term which is a complex function of the water temperature. In general, it is difficult to obtain closed-form solutions of this governing equation by analytic methods. A numerical solution, utilizing a predictor-corrector scheme, is developed for the governing equation to predict the transient-period and the steady-state temperature distributions in thermally loaded streams under changing thermal input rates and meteorological conditions. (Pollut. Abstr.)

14864 ANALYSIS OF FLOW DYNAMICS AND MIXING ALONG THE COAST: THE CASE OF THERMAL EFFLUENTS. Kumagai, M.; Nishimura, H. (Tokyo Univ.). Heat Transfer-Jpn. Res.; 4: No. 3, 61-69(1975).

Translated from Kagaku Kogaku; 38: 751-756(1974).

The behavior of waste water near outfall was found to be classified into two distinct regions according to Richardson number Ri, which represents the vertical stability of water layer. In the region of $Ri > 1$, a stable surface water layer is formed which flows with constant thickness and with velocity decreasing inversely with the distance from outfall. In the region of $Ri < 1$, the surface water layer entrains bottom water while it spreads. These two may be called stably stratified regions and entrainment regions, respectively. Analysis of actual data of thermal waste water from power plants shows that the entrainment region lies in the immediate vicinity of outfall, with an area of about 0.001 km^2, and beyond it lies the stably stratified region. On the basis of this analysis, a mathematical model was derived which can well approximate the temperature distribution of thermal waste water in the environment. (auth)

14865 SOME RESULTS OF THE ACTION OF WARM WATERS FROM THERMAL STATIONS ON THE EMISSARIES. Chiriac, V. pp 384-391 of Water for the Human Environment. Vol. II. Chow, V. T. (Ed.). Champaign, IL; International Water Resources Association (1973).

From 1st world congress on water resources; Chicago, Illinois, USA (24 Sep 1973). See CONF-7309143-P2.

Some aspects of thermal pollution studies developed in Romania are exemplified with data concerning the Jiu River and the Siut-Ghiol Lake. Research has shown that the warm water discharged into these waters has a fairly small influence on the physical-chemical and biological characteristics of their waters. (PCS)

14866 METABOLIC STUDIES ON THE AMPHIPOD ANISOGAMMARUS PUGETTENSIS IN RELATION TO ITS TROPHIC POSITION IN THE FOOD WEB OF YOUNG SALMONIDS. Chang, B. D.; Parsons, T. R. (Univ. of British Columbia, Vancouver). J. Fish. Res. Board Can.; 32: No. 2, 243-247(1975).

The marine amphipod Anisogammarus pugettensis has been studied as part of the natural food of young salmon and as a potential organism for aquaculture projects. It has been shown to be an omnivore capable of eating seaweed, diatoms, fish pellets, and fish. It survived well under eurythermal and euryhaline conditions but grew best (14% of body weight per day) at a salinity of 28‰ and 20 C. Growth efficiency (K_1) was between 19 and 34%, depending on the size of animal and temperature. (auth)

Chemical Effluents

Refer also to abstracts 15105 and 15900.

14867 (ORNL-EIS--83) NSF-RANN TRACE CONTAMINANTS PROGRAM DIRECTORY. Wilkinson, B. K.; Smith, S. K. (Oak Ridge National Lab., Tenn. (USA)). Dec 1975. Contract W-7405-eng-26. 84p. Dep. NTIS $5.00.

Research programs in the USA on pollution of the environment by trace amounts of toxic elements are outlined. (CH)

14868 (ORNL-EIS--84) NSF-RANN TRACE CONTAMINANTS ABSTRACTS. Copenhaver, E. D. (ed.). (Oak Ridge National Lab., Tenn. (USA)). Dec 1975. Contract W-7405-eng-26. 38p. Dep. NTIS $4.00.

Abstracts of 64 reports on the contamination of air, soil, and water by trace amounts of toxic elements are presented. Abstracts of papers that describe measuring methods are also included. (CH)

14869 CONTAMINATION OF THE WATERS WITH ENVIRONMENTAL CHEMICALS AND RADIOACTIVE MATERIALS. Enke, C. G. Wasser, Luft Betr.; 19: No. 8, 468-469(Aug 1975). (In German).

3 figs.

Everywhere in our environment there are substances which are dangerous to health and whose behavior, toxicity, and carcinogenic action are still largely unknown in spite of all technical development. Even more attention than in the past should therefore be paid to the absolute safety of all facilities, the measurement and registration of all hitherto unknown values, and the efficient disposal of the many solid and liquid wastes. (DE)

INSTRUMENTATION

Radiation Detection Instruments

General Detectors and Monitors

Refer also to abstracts 14786, 15011, 15110, 15140, 16503, 16514, and 16534.

14870 (AEC-tr-7315, pp 75-82) STABILIZATION OF VOLTAGE AND DISCRIMINATION LEVEL FOR A SCINTILLATION DATA-UNIT IN beta-RAY DETECTION. Mashinin, V. A.; Salakhov, A. M. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

The plateau in the counting characteristics of scintillation detectors for beta detection is studied. It was found that there is a plateau both for the voltage of the photomultiplier and the registration threshold. (WHK)

14871 (AEC-tr-7315, pp 116-123) GAUGE FOR PULSE NEUTRON FLUXES. Kir'yanov, G. I.; Kozma, A. S.; Kosorotov, N. A. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

A proton-recoil polystyrene scintillation detector for measuring fast neutron fluxes in the range 10^6 to 10^{11} neutrons/sec is described. (WHK)

14872 (AEC-tr-7315, pp 144-148) REVERSING PULSE COUNTER BASED ON DECATRONS OF A NEW TYPE. Isaev, V. S.; Lavrent'ev, Yu. D.; Mamikonyan, S. V. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

A circuit diagram and specifications are given for the pulse counter for use in x-ray radiometric equipment. (WHK)

14873 (BARC-792) PREPARATION OF 2,5 DIPHENYLOXAZOLE (PPO) AND 1,4 DI-[2-(5-PHENYLOXAZOLYL)]-BENZENE (POPOP). Dhane, D. L.; Noras, K. A.; Mushrif, A. U.; Gaiki, G. M.; Hirwe, S. P. (Bhabha Atomic Research Centre, Bombay (India). Chemical Engineering Div.). 1975. 24p. Dep. NTIS (US Sales Only) $3.50.

A convenient method with overall high yield has been described for the synthesis of 2,5-diphenyloxazole (PPO) IV and 1,4-di-[2-(5 phenyloxazolyl)]-benzene (POPOP) VIII which are widely used as organic scintillators. This involved the conversion of hippuric acid (I) to hippuryl chloride (II) and the acylation of benzene with II using anhydrous aluminium chloride to give N-phenacylbenzamide (III). III was cyclodehydrated to PPO(IV). Acid hydrolysis of III gave ω-aminoacetophenone hydrochloride (V) which was coupled to terephthalyl chloride (VI) in the presence of aqueous sodium carbonate to yield N, N'-diphenacylterephthalamide (VII). VII was cyclodehydrated to POPOP(VIII). NMR, IR, absorption and fluorescence spectral data of PPO and POPOP have been recorded. (auth)

14874 (BNL-20720) POSITION SENSING BY CHARGE DIVISION. Alberi, J. L.; Radeka, V. (Brookhaven National Lab., Upton, N. Y. (USA)). Nov 1975. 15p. (CONF-751116-24). Dep. NTIS $3.50.

From nuclear science symposium; San Francisco, California, USA (17 Nov 1975).

A summary of a comprehensive analysis of theoretical and practical aspects of position sensing by charge division from resistive electrodes is presented. Properties of transformer decoupling of the resistive electrode from detector bias voltage are analyzed and compared to the usual capacitive decoupling methods. Optimization and limitation of signal shaping is discussed as a function of diffusion time constant, signal rise times, and notes. (auth)

14875 (CEA-CONF-3043) POSITION ENCODER. Goursky, V. (CEA Centre d'Etudes Nucleaires de Saclay, 91- Gif-sur-Yvette (France). Services d'Electronique). 1975. 5p. (In French). INIS.

From electronics information meeting; Saclay, France (15 Apr 1975).

A position encoder is described, specially designed for the treatment of signals from localization detectors. It gives position x from the position signal Ex and the energy signal E resulting from a given event. It is made up of two functional elements: an analog operator which gives a signal of duration proportional to the quotient Ex/E from the expression t = Q/I = CV/I (with V input voltage = Ex, and I constant discharge current = kE); a 200 MHz coding scaler which supplies the result in digital form. (FR)

14876 (CEA-N-1791, pp 225-227) EXPERIMENTAL TECHNIQUES: USE OF GAS COUNTERS FOR MEASURING THE CHARGE OF HEAVY IONS. Girard, J. [nd]. (In French).

In Department of Nuclear Physics. Progress report, 1 October 1973-30 September 1974. (CEA Centre d'Etudes Nucleaires de Saclay, 91- Gif-sur-Yvette (France). Dept. de Physique Nucleaire).

Some results concerning the identification of the charge of heavy ions by a gas proportional counter are given. (FR)

14877 (GJO-1656) DEVELOPMENT OF AN ATMOSPHERIC ^{214}Bi MEASURING INSTRUMENT. (Geodata International, Inc., Dallas, Tex. (USA)). 7 Nov 1975. Contract AT(05-1)-1656. 52p. Dep. NTIS $4.50.

Part of the radiation environment encountered during airborne gamma ray surveys is produced by ^{214}Bi existing in the atmosphere. The ^{214}Bi atmospheric concentration changes with time and location, and should be measured to process the acquired data correctly. Three methods of atmospheric ^{214}Bi measurement are evaluated in this work. These are: (1) an 11½" dia. x 4" thick NaI(Tl) crystal shielded from ground radiation, (2) a negatively charged wire to collect radioactive ions, and (3) a high volume air sampler collecting particulate matter on filter paper. The shielded detector and filter paper methods yield good results with the shielded detector producing a factor of about 10 times higher counting rate. The charged wire method gave very low counting rates where the shielded detector counting rates were about a factor of 100 times higher, and the results did not correlate with the ^{214}Bi atmospheric concentration as determined by the other two methods. The theory necessary to understand the collection and decay of the airborne radioactivity using the charged wire and filter paper methods is developed. (auth)

14878 (ORNL-TM-5222) ONE- AND TWO-DIMENSIONAL LEAST-SQUARES SMOOTHING AND EDGE-SHARPENING METHOD FOR IMAGE PROCESSING. Bell, M. R. (Oak Ridge National Lab., Tenn. (USA)). Jan 1976. Contract W-7405-eng-26. 37p. Dep. NTIS $5.00.

A rapid method is developed for two-dimensional smoothing and edge-sharpening by the least-squares fitting of a function to a limited area of the data. This convolution or matrix weighting is applied at each point of the data set to yield a smoothed or a sharpened image. Weighting matrices for 3 x 3, 5 x 5, and 7 x 7 point fitting areas are provided for polynomial function fits of all degrees up to the highest degree determinable. For the 7 x 7 point fitting area weights for fitting functions of up to the quartic in both dimensions are supplied. Application of the 5 x 5 point quadratic fit smoothing to a nuclear medicine image is shown as an example. (auth)

14879 (RDT-C-10-3T(Rev.)(12-75)) MULTIPLE INPUT PREAMPLIFIER/DISCRIMINATOR FOR USE WITH NEUTRON COUNTERS. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). Dec 1975. 20p. RSO.

This standard covers a multiple input preamplifier/discriminator for use with neutron counters where it is desired to combine the counter signals. It presents the required performance and the tests to determine this performance. The preamplifier is of the charge sensitive type and performs required pulse shaping. Each preamplifier feeds a separate discriminator. Each discriminator has a remote adjustment with optional internal adjustment, and all discriminator outputs are summed at the cable driver stage. (auth)

14880 (RTD-C-15-11T(12-75)) BF_3 GAMMA TOLERANT NEUTRON DETECTOR TUBES. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). Dec 1975. 19p. RSO.

This standard covers the requirements for a high gamma tolerant, BF_3 filled proportional counter (also called detector) for use in neutron detection systems requiring operation in gamma flux environments to 10^3 R/hr. This standard applies only to the detector; however, when used with other appropriate standards or specifications, it is intended that more complete assemblies (integral detector and cable or special shielded systems) can be obtained. Required performance characteristics are detailed, and the tests to assure this performance are described. (auth)

14881 (UCRL-76894) THEORETICAL BAND STRUCTURE ANALYSIS ON POSSIBLE HIGH-Z DETECTOR MATERIALS. Yee, J. H.; Sherohman, J. W.; Armantrout, G. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 Nov 1975. 11p. (CONF-751116-11). Dep. NTIS $4.25.

From nuclear science symposium; San Francisco, California, USA (17 Nov 1975).

Theoretical energy band structure calculations have been utilized to investigate several high-Z materials for potential use as ambient temperature radiation detectors. Using the pseudopotential technique, the band structure for HgI_2 has been determined and the effective masses of the holes and electrons have been estimated. Theoretical mobilities of the electrons and holes as a function of temperature have been computed for HgI_2 and CdTe and are compared to experimental data. (auth)

14882 ISOCOUNT SCINTILLATION SCANNER WITH PRESET STATISTICAL DATA RELIABILITY. Ikebe, J.; Yamaguchi, H.; Nawa, O. A. (to Hitachi Medical Corp.). US Patent 3,916,199. 28 Oct 1975. Priority date 29 Aug 1972, Japan. 8p.

A scintillation detector scans an object such as a live body along horizontal straight scanning lines in such a manner that the scintillation detector is stopped at a scanning point during the time interval T required for counting a predetermined number of N pulses. The rate R/sub N/ equals N/T is then calculated and the output signal pulses the number of which represents the rate R or the corresponding output signal is used as the recording signal for forming the scintigram. In contrast to the usual scanner, the isocount scanner scans an object stepwise in order to gather data with statistically uniform reliability. (auth)

14883 AMPLIFIED-SCINTILLATION OPTICAL-CODED RADIOISOTOPE IMAGING SYSTEM. Coltman, J. W.; Vaerewyck, E. G. (to Westinghouse Electric Corp.). US Patent 3,916,198. 28 Oct 1975. Filed date 1 Jun 1973. 10p.

A radioisotope imaging system is described wherein the position of an amplified scintillation is determined by optical coding means that is essentially insensitive to variations in the strength of the scintillation. This permits a more accurate position location and, therefore, a higher resolution in the final image. At the same time, sensitivity remains high, as does discrimination in energy. (auth)

14884 RADIATION FLUX MEASURING DEVICE. Corte, E.; Maitra, P. (to General Atomic Co.). US Patent 3,916,193. 28 Oct 1975. Filed date 31 Aug 1973. 6p.

A radiation flux measuring device is described which employs an attenuator circuit, the output of which is maintained constant, connected to a radiation detector. Means connected to the attenuator circuit produce an output representing the log of the a-c component of the radiation detector, thereby providing a true root mean square logarithmic output. (auth)

14885 METHOD OF AND APPARATUS FOR EXAMINING A BODY BY RADIATION SUCH AS X OR GAMMA RADIATION. Hounsfield, G. N. (to EMI Ltd.). US Patent 3,919,552. 11 Nov 1975. Priority date 23 Aug 1968, United Kingdom of Great Britain and Northern Ireland (UK). 14p.

Apparatus is disclosed for examining a body by means of radiation such as X or gamma radiation. The body to be examined is inserted in an aperture in a scanning and locating structure, which structure supports a source of the radiation and detector means therefor on opposite sides of the aperture. The source and detector means are moveable to and fro on the structure so as to scan the radiation laterally across the body in a plane and the structure is rotatable around the body about an axis perpendicular to the plane. Disposed between the source and detector means is an attenuator means which extends laterally in said plane to the full extent of the lateral scanning motion and rotates with the structure. (auth)

14886 ELEVATOR MECHANISM AND METHOD FOR SCINTILLATION DETECTORS. Frank, E. (to Packard Instrument Co., Inc.). US Patent 3,919,554. 11 Nov 1975. Filed date 11 Jun 1973. 2p.

An elevator mechanism and method for raising and lowering radioactive samples through a shielded vertical counting chamber in a benchtop scintillation detector is described. The elevator mechanism adds little or nothing to the height of the detector by using an elongated flexible member such as a metal tape secured to the bottom of the elevator platform and extending downwardly through the counting chamber and its bottom shielding, where the tape is bent laterally for connection to a drive means. In the particular embodiment illustrated, the tape is bent laterally below the bottom shielding for the counting chamber, and then upwardly along or through one side of the shielding to a reel at the top of the shielding. The tape is wound onto the reel, and the reel is driven by a reversible motor which winds and unwinds the tape on the reel to raise and lower the elevator platform. (auth)

14887 WHOLE BODY LINE SCANNER. Berninger, W. H. (to General Electric Co.). US Patent 3,919,557. 11 Nov 1975. Filed date 15 May 1974. 24p.

A bar-shaped scintillator converts incident collimated gamma rays to light pulses which are detected by a row of photoelectric tubes positioned along the output face of the scintillator wherein each tube has a convexly curved photocathode disposed in close proximity to the scintillator. Electronic circuitry connected to the output of phototubes develops the scintillation event x-axis position coordinate electrical signal with good linearity and with substantial independence of the spacing between the scintillator and photocathodes so that the phototubes can be positioned as close to the scintillator as possible to obtain reduced distortion in the field of view and improved spatial resolution. A mechanical drive of the scanner results in an image of the gamma ray source being formed by sequencing the developed scintillation position coordinate signals in the y-axis dimension. (auth)

14888 DEPENDENCE OF THE Ge(Li) EFFICIENCY SLOPE ON THE SOURCE-TO-DETECTOR DISTANCE. Grant, P. M. (Los Alamos Scientific Lab., N. Mex. (USA)). Nucl. Instrum. Methods; 127: No. 3, 371-372(15 Aug 1975).

The slope of the linear portion of a Ge(Li) log(efficiency) vs log(energy) plot varies with the source-to-detector distance and crystal geometry. Such considerations should be remembered when applying the empirical function which related this slope to the detector geometry. Such considerations should be remembered when applying the empirical function which relates this slope to the detector active volume. (NL)

14889 A HELICAL-CATHODE PROPORTIONAL CHAMBER SYSTEM FOR A CHARGED-PARTICLE SPECTROMETER. Stoub, E. W.; Ristinen, R. A.; Sercely, R. R. (Colorado Univ., Boulder (USA). Nuclear Physics Lab.). Nucl. Instrum. Methods; 127: No. 3, 329-337(15 Aug 1975).

The helical-cathode proportional chamber system described is used with the charged-particle spectrometer at the University of Colorado Nuclear Physics Laboratory. A theoretical analysis of the proportional chamber is presented which predicts observed behavior. Experimental results are presented. The chamber exibits an active volume about 68 cm long (the position-sensing direction) by 5.0 cm wide by 1.3 cm thick. The spatial resolution (fwhm) is about ½ mm. Propane is used as a filling gas. (NL)

14890 A NUCLEAR PROPORTIONAL COUNTER. (to Agence Nationale de Valorisation de la Recherche (ANVAR)). French Patent 2,227,633/A/. 24 Apr 1973. 7p. (In French)

The invention relates to a nuclear proportional counter comprising in a bulb filled with a low-pressure gas, a wire forming an anode and a cathode, characterized in that said cathode is constituted by two plane plates parallel to each other and to the anode wire, and in that two branches of a circuit are connected to the anode wire end-portions, each branch comprising a preamplifier, a measuring circuit consisting of a differentiator-integrator-differentiator amplifier and a zero detector, one of the branches comprising an adjustable delay circuit, both branches jointly attacking a conversion circuit for converting the pulse duration into amplitudes. The conversion circuit is followed by a multi-channel analyzer, contingently provided with a recorder. (FR)

14891 SEMICONDUCTOR NUCLEAR RADIATION DETECTORS. Recent Developments. Siffert, P.; Ponpon, J. P.; Cornet, A. (Centre National de la Recherche Scientifique, 67-Strasbourg (France). Centre de Recherches Nucleaires). Onde Electr.; 55: No. 5, 281-297(May 1975). (In French)

Gamma spectroscopy uses semiconductors of atomic number as high as possible. Until recently germanium only was used, in devices of N-I-P structure (P-doped-intrinsic N-doped region) which had to be used and kept at low temperature; germanium detectors of NP structure have now been developed and have the advantage that they can be kept at room temperature. However germanium is not the ideal material for all applications and many laboratories are now studying cadmium telluride and mercuric iodide detectors. (FR)

14892 SCINTILLATOR BASED ON HEXAFLUOROBENZENE. Kozlov, Yu. V.; Martem'yanov, V. P.; Tarasenkov, V. G.; Poduzhailo, V. F. (Inst. of Atomic Energy, Moscow). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 737-739(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 64-66(1975).

Absorption and luminescence spectra of various activating additives in hexafluorobenzene (C_6F_6) are given. The scintillation efficiency of C_6F_6-based liquid scintillators and the effect of the purity of the C_6F_6 on the luminous efficiency were determined. It is shown that a 20% resolution for electrons with E ~ 1 MeV can be obtained with a scintillator containing 10 g/liter 2-(4-biphenylyl)-5 phenyloxazole + 0.1 g/liter dimethyl POPOP in C_6F_6. (auth)

14893 HIGHLY EFFICIENT 1.8-TON SCINTILLATION COUNTER FOR PROTON DETECTION. Bezrukov, L. B.; Enikeev, R. I.; Korchagin, V. B.; Ryazhskaya, O. G. (Inst. of

Nuclear Research, Moscow). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 740-742(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 66-68(1975).

A liquid scintillation counter designed for the detection of neutrons generated in showers due to inelastic scattering of cosmic-ray muons is described. The counter contains 1.8 ton of organic scintillator consisting of white spirit with Gd octoate dissolved in it. The neutron detection efficiency, measured with the aid of ^{252}Cf placed at the center of the counter, is $(83 \pm 1)\%$. (auth)

14894 TEMPERATURE DEPENDENCE OF EFFICIENCY OF A LARGE LIQUID SCINTILLATION DETECTOR. Voevodskii, A. V.; Sten'kin, Yu. V. (Inst. of Nuclear Research, Moscow). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 743-744 (1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 69-70(1975).

The effect of temperature on the properties of a scintillation detector composed of a 150-liter container filled with a white-spirit liquid scintillator and a FÉU-49 photomultiplier was investigated. (auth)

14895 THICK-WALLED IONIZATION CHAMBER. Nikitin, V. A.; Vatset, P. I. (Physicotechnical Inst., Kharkov). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 745-746(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 70-71(1975).

A thick-walled ionization chamber for measurement of the energy flux of low-intensity photons is described. The chamber is calibrated in the energy range 600 to 1300 MeV against a quantameter and has a sensitivity of $(9.5 \pm 0.5)10^{-19}$ C/MeV in integral operation and $3 \cdot 10^{-9}$ V/MeV in pulse operation. (auth)

14896 USING NUCLEAR EMULSIONS FOR LONG-EXPOSURE RECORDING OF LOW-ENERGY DEUTERONS IN VACUUM AND IN HELIUM. Barit, I. Ya.; Balashko, Yu. G.; Dul'kova, L. S.; Zavarzina, V. P.; Romanova, T. A. (Inst. for Nuclear Research, Moscow). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 726-729(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 55-58(1975).

Experience gained in recording 700 to 950 keV deuterons by means of domestically produced fine-grain type T-3 and P-9 nuclear photoemulsions is described; the experiments were carried out in vacuum and in a helium atmosphere; allowance is made for the possible variation in photolayer parameters during long exposures. (auth)

14897 OPERATING CHARACTERISTICS OF GAS-FILLED PROPORTIONAL COUNTERS WITH A NONSOLID CATHODE. Balonov, M. I. (Scientific Research Inst. for Radiation Hygiene, Leningrad). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 730-732(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 58-60(1975).

The influence of external electrostatic fields on the radiometric characteristics of counters with mesh cathodes for β counting of solid sources with low background level is investigated. (auth)

14898 USE OF PHOTORESISTORS TO CORRECT THE CURRENT RESPONSE OF GAS-DISCHARGE COUNTERS. Avdonkin, S. I.; Kuznetsov, Yu. A.; Sidorenko, A. V. (Leningrad Aircraft Instrument Design Inst.). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 733-734(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 60-62(1975).

A circuit used to connect gas-discharge counters for current operation with extended range of radiation-level measurement is described. The load curve is corrected by means of photoresistors that change their value as a function of the radiation level; they are connected into the counter load circuit. (auth)

14899 MEASUREMENTS OF LOW LEVEL ACTIVITIES BY CLOUD CHAMBERS. Chrapan, J. (Komenskeho Univ., Bratislava). Acta Fac. Rerum Nat. Univ. Comenianae, Phys.; 15: 207-212(1975). (In Czech)

The measurements of low activities by cloud chambers is discussed. It seems that diffusion cloud chambers are a suitable device for the measuring of nature α activities and fission fragments. (auth)

14900 SIMULTANEOUS MEASUREMENT OF VERY LOW ^{3}H AND ^{14}C ACTIVITIES. Povinec, P. (Komenskeho Univ., Bratislava). Acta Fac. Rerum Nat. Univ. Comenianae, Phys.; 15: 183-197(1975). (In Czech)

A new method of simultaneous measurement of very low ^{3}H and ^{14}C activities is described, using double labeled methane as a gas filling of a proportional counter. Results of simultaneous measurements of ^{3}H and ^{14}C concentrations in biospheric and atmospheric samples are presented. (auth)

14901 LIQUID SCINTILLATORS FOR LOW ^{3}H ACTIVITY MEASUREMENTS. Duka-Zolyomi, A. (Komenskeho Univ., Bratislava). Acta Fac. Rerum Nat. Univ. Comenianae, Phys.; 15: 213-231(1975). (In Czech)

The paper deals with the occurence of the radioactive isotope of hydrogen ^{3}H, which is distributed in the atmosphere, biosphere and hydrosphere. Using this soft β emitter it is possible to study various processes in these spheres. As the disintegration energy of ^{3}H is very low and also its concentration in nature, it is necessary to use very sensitive methods for its detection. One way is by using liquid scintillators. A comparison of various liquid scintillators, based on dioxane and toluene is presented. This analysis is done for obtaining a high factor of merit. The characteristics of various counting vials are discussed. The measurements have been carried out using Packard Liquid Scintillation Spectrometer TRI-CARB, model 2111-01. (auth)

14902 SCINTILLATION CAMERA. Zioni, J.; Klein, Y.; Inbar, D. (to Elscint Ltd., Haifa (Israel)). German (FRG) Patent 2,442,872/A/. 13 Mar 1975. 49p. (In German)

The scintillation camera is to make pictures of the density distribution of radiation fields created by the injection or administration of radioactive medicaments into the body of the patient. It contains a scintillation crystal, several photomultipliers and computer circuits to obtain an analytical function at the exits of the photomultiplier which is dependent on the position of the scintillations at the time in the crystal. The scintillation crystal is flat and spatially corresponds to the production site of radiation. The photomultipliers form a pattern whose basic form consists of at least three photomultipliers. They are assigned to at least two crossing parallel series groups where a vertical running reference axis in the crystal plane belongs to each series group. The computer circuits are each assigned to a reference axis. Each series of a series group assigned to one of the reference axes in the computer circuit has an adder to produce a scintillation dependent series signal. Furthermore, the projection of the scintillation on this reference axis is calculated. A series signal is used for this which originates from a series chosen from two neighboring photomultiplier series of this group. The scintillation must have appeared between these chosen series. They are termed as basic series. The photomultiplier can be arranged hexagonally or rectangularly. (DE)

14903 SCINTIGRAPHIC COLLIMATOR. Frost, D.; Zwiebel, H. (to Bandelin Elektronic K. G., to Berlin (F. R. Germany)). German(FRG) Patent 2,351,450/A/. 24 Apr 1975. 9p. (In German)

The scintigraphic collimator focusses γ-radiation emitted from an organ of the patient examined. Prior to the examination, the organ was labelled with a radioactive isotope commonly used in nuclear medicine. The collimator is fitted into a scintillation detector and produces an oblong isoresponse line distribution long enough to go beyond the thickness of the organ examined. To achieve this oblong distribution the collimator is composed of several concentric heavy-metal cone frustum shells enveloping each other whose radiotransparent intermediate air spaces widen outwards. In the center of the collimator, a γ-radiopaque heavy-metal cylinder or cone frustum is mounted longitudinally. The heavy metal of which the cone frustra are made is depleted uranium. (DE)

14904 COOLED DETECTOR SYSTEM WITH A SEMICONDUCTOR DETECTOR. Schmitz, J.; Wolf, R. (to Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (F. R. Germany)). German (FRG) Patent 2,347,823/A/. 10 Apr 1975. 9p. (In German)

The detector system for cooling uses a semiconductor detector of the type of a Si(Li)-, Ge(Li)-Ga(AS) element to detect radioactive radiation and is arranged in a borehole probe. The cooling takes place by means of at least one Peltier element whose cold side has thermal contact to the support for the semiconductor detector and whose warm side has thermal contact to the casing of the probe. The detector system is almost independent of the position of the energy supply or of the cooling aggregate and of the measuring site by means of this cooling method. It is also possible to connect several Peltier elements in cascade. (DE)

14905 INVESTIGATION OF CHARACTERISTICS OF LOW BACKGROUND GAS FLOW GM COUNTERS. Usacev, S.; Hlinka, V.; Povinec, P. (Komenskeho Univ., Bratislava). Acta Fac. Rerum Nat. Univ. Comenianae, Phys.; 15: 249-262(1975). (In Czech)

A construction of gas flow GM counters for measurement of low β activities in $2 \times 2\pi$ geometry is described and the working characteristics of these counters are investigated. Characteristics of a $2 \times 2\pi$ $\beta - \gamma$ coincidence spectrometer consisting of a NaI(Tl) scintillation detector and a GM counter are presented. (auth)

14906 INVESTIGATION OF GAS AMPLIFICATION IN PROPORTIONAL COUNTERS WITH HYDROCARBON GAS FILLING. Povinec, P.; Durana, L. (Komenskeho Univ., Bratislava). Acta Fac. Rerum Nat. Univ. Comenianae, Phys.; 15: 169-181(1975). (In Czech)

Formulas for calculation of gas amplification factor in proportional counters filled with hydrocarbons are verified. On the base of analysis of experimental results two new formulas for calculation of gas amplification factor are proposed, which have a general validity and may be used also for other gas fillings. (auth)

14907 CALIBRATION OF THE γ RAY EFFICIENCY OF Ge(Li) SPECTROMETERS WITH ^{152}Eu. Debertin, K.; Schoetzig, U.; Weiss, H. M. PTB Mitt.; 85: No. 3, 187-195(Jun 1975). (In German)

8 figs.; 5 tabs.; 12 refs.

The γ-ray efficiency of Ge(Li) spectrometers is commonly calibrated by using a set of sources of different radionuclides with known activity or γ-ray emission rate. This procedure, however, is time consuming and depends on the availability of all these nuclides, also those with short half-lives. In the energy region 100 keV to 1,500 keV a fast calibration which can be repeated at any time, is possible by using a ^{152}Eu standard source. ^{152}Eu has a long half-life (13a) and emits in this energy interval several strong lines the emission probability of which has been determined. An uncertainty of about ±1% can be assigned to the γ-ray emission rates of ^{152}Eu standard sources. (DE)

14908 A PROBABILITY DENSITY FUNCTION OF THE RATIO OF TWO COUNTING RATE VARIANCE ESTIMATORS IN RADIOACTIVITY MEASUREMENTS. Pazdur, M. F. (Silesian Technical Univ., Gliwice, Poland). Acta Phys. Pol., Ser. A48: No. 1, 175-178(Jul 1975).

The ratio of two counting rate variance estimators is expressed as a product of constant and two random variables. The probability density function of this ratio is derived assuming approximation of the Poisson distribution by normal distribution. The formulae for mean and variance are also given. (auth)

14909 GAMMA CAMERA FIELD UNIFORMITY CORRECTION. Causer, D. A. (Aberdeen Univ., Eng.). Br. J. Radiol.; 48: No. 575, 955(Nov 1975).

The correction of ^{99m}Tc scans using a solid ^{57}Co flood source (Radiochemical Centre, Amersham) is reported. Excellent results were obtained provided that the count rates of both the flood field and the scan were below 10,000 counts per second. These results conflict with those of Hannan and Bessent (Hannan, W. J., and Bessent, R. G., 1974, Br. J. Radiol., vol. 47, 820), although baseline shifting occurred at count-rates greater than 10,000 counts per second, and discrepancies in camera correction similar to those described by these authors were then obtained. The presence of scattering material was found to have a more important effect on camera correction than the use of ^{57}Co. A possible explanation of the discrepancy with Hannan and Bessent's results could be provided by a higher level of contamination of their ^{57}Co source with ^{56}Co, ^{58}Co and ^{60}Co than of the Amersham source (<0.2% impurities). An undesirable increase in statistical fluctuations, which could be improved by smoothing the camera correct frame, was produced by camera correction on a system which restricted the total counts collected in a channel to 4,095. (UK)

14910 MODIFICATION OF COMMON MULTICHANNEL-PULSE-HEIGHT-ANALYZERS FOR EXTERNAL ON-LINE CONTROL VIA PROCESS CONTROL COMPUTER IN CLOSED-LOOP. Hamann, C. (Freie Univ. Berlin (F. R. Germany). Klinikum Steglitz). Atomkernenergie; 26: No. 2, 133-141(1975). (In German).

16 figs.; 4 refs.

By using two analyzers of different manufacture the modification for the purpose of external control is described. Relays are incorporated in the analyzers in order to allow the manually operated switch functions to be actuated electrically. Relays are controlled via electronic modules, in which—by means of logical linking and interlocking—interfaces are provided for the computer to equalize the idiosyncrasy of the analyzers. The actual analyzer function is communicated to the computer by the interface via a "status word" so that the digital loop is closed. At the end of study the modification of an analyzer's Teletype-output to a fast electronic interface is outlined. (DE)

14911 SCINTILLATOR AND APPARATUS USING A SCINTILLATOR FOR THE DETECTION OF PENETRATING RADIATION. Willison, B. R. (to EMI Ltd.). German(FRG) Patent 2,446,226/A/. 10 Apr 1975. 13p. (In German).

2 figs.

The scintillator contains a scintillation crystal and a detector for the scintillations in the crystal produced by X-ray or γ-irradiation. The crystal consists of an alkali halogenide doped with thallium such as sodium iodide or cesium iodide. The thallium is for the improvement of the effectiveness of the crystal for the wave conversion in the visible spectrum. The thallium content of the crystal is kept between 25 and 200 ppm of the alkali halogenide to reduce the share of simultaneously occurring and interfering phosphorescence. The scintillator can be used in X-ray diagnostics equipment in which cross-section planes of patients are registered. The detector can be placed in various positions to the patient. (DE)

14912 NUCLEAR MEDICINE. Proceedings of a Symposium on Nuclear Medicine, Utrecht, Netherlands, 24–25 October 1975. Ephraim, K. H.; Oei, H. Y. (eds.). Utrecht; Institute for Nuclear Medicine (1975). vp.

Separate abstracts are prepared for the 25 papers presented. (CES)

For abstracts of individual papers see: 14251, 14855, 15053, 15054, 15057, 15073, 15092, 15093, 15108, and 15140–15165.

Radiation Dosimeters

Refer also to abstract 16112.

14913 (BNL-20762) COMPOSITE DAMAGE TRACK-ALBEDO PERSONNEL NEUTRON DOSIMETER FOR GENERAL USE. Distenfeld, C. H. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 7p. (CONF-760202-25). Dep. NTIS $3.50.

From 9th topical symposium on operational health physics; Denver, Colorado, USA (9 Feb 1976).

No known detector or series of detectors in personnel neutron dosimeters have correct dose equivalent energy-dependence. Useful dosimeter performance is assumed by calibrating dosimeters for the exposure spectrum. This method implies that the exposure spectrum will be constant within a given facility or the wearer will not be exposed to different spectra in other areas. Since exposure spectra are known to vary widely a composite damage track-albedo personnel neutron dosimeter was developed to separately respond to the softer and more energetic parts of various spectra. The relationships of the responses of the elements vary with different spectra and are used to convert dosimeter readings to dose equivalent. Measurements indicate that dose equivalent deviation was less than approximately 50 percent for unshielded lucite and steel shielded HPRR spectra, monoenergetic spectra from 4.7 to 15 MeV, a ^{252}Cf spontaneous neutron spectrum and an AmBe spectrum. Dosimeter sensitivity was similar to present NTA film methods. The composite personnel neutron dosimeter was also tested with calculated spectra by simulating badge response through known energy-dependence of the badge elements. Dose equivalent deviation was less than approximately 20 percent for 19 significantly different assumed spectra. Thus, the experimental and calculational results support adherence to the dose equivalent for common exposure spectra. (auth)

14914 (INIS-mf-1740) CHEMICAL DOSIMETRY OF A HIGH ACTIVITY IRRADIATION SOURCE OF ^{60}Co. Carcia S, I. M. E. (Universidad Veracruzana, Orizaba (Mexico). Facultad de Ciencias Quimicas). 1974. 98p. (In Spanish). INIS.

Thesis.

With the introduction of the classical Fricke dosimeter, composed of ferrous ions in sulfuric acid medium with dose limits between 4×10^3 and 4×10^4 rad, chemical dosimetry has been useful for the determination of absorbed doses. In the Center of Nuclear Studies there is a panoramic irradiator with an activity of 40,000 Ci consisting of 60 cylinders of ^{60}Co placed in 12 exposure tubes of variable diameter. A study was made with the Fricke dosimeter to obtain the dose values in the irradiation field, to determine if the placement of the cylinders consitutes a point source, and to determine the behavior of the Fricke dosimeter (modified by the addition of cupric ions to extend its upper limits). An aerated solution of $FeSO_4 \cdot 7H_2O$, $CuSO_4 \cdot 5H_2O$, and H_2SO_4 in tridistilled water was irradiated in the central position of the irradiator with diameters of 11.4, 30, and 80 cm in glass containers. The ferric ion formed was determined spectrophotometrically at an optimum wavelength of 304 nm both for the ferric ions alone and mixed with ferrous and cupric ions. The dosimeter has a linear response from 10^4 up to 10^5 rad with saturation at 6×10^5 rad. The results also showed the isotropy of the source. (tr-INIS)

14915 (INIS-mf-1846) LiF (TLD-100) DOSIMETRY BASED ON RADIOPHOTOLUMINESCENCE. Levita, M. (Tel Aviv Univ. (Israel). Dept. of Physics). Feb 1975. 73p. (In Hebrew). INIS.

Thesis.

This work contains a study of radiophotoluminescence (RPL) of LiF(TLD-100) single crystals or pellets conducted for the purpose of the development of a dosimetric system based on the RPL phenomenon induced by ionizing radiation. The first chapter deals with the present status of TL (thermoluminescence) and RPL dosimetric systems and with the motivation for this work. Among the properties examined were excitation and emission spectra, the correlation between the intensity of the emitted light and the radiation exposure, thermal stability and build-up, and optical stability. Following this research was developed a dosimetric system for ionizing radiation based on the intensity measurement of the red light (660 nm) emitted by LiF (TLD-100) dosimeters excited by blue light (440 nm). This method of measurement is nondestructive. (INIS)

14916 (INR-1478/19/D/B) DETERMINATION OF DOSIMETRY PARAMETERS OF MIXED RADIATION BY USE OF THREE ANALOG DETECTORS. Bobrowski, L.; Zielczynski, M. (Institute of Nuclear Research, Warsaw (Poland)). 1973. 22p. (In Polish). INIS.

Calculations have been performed, which demonstrate the possibility of determination of absorbed dose, dose equivalent and dispersion of quality factor values of mixed radiation of any spectrum by use of three analog detectors having appropriate sensitivity characteristics. (auth)

14917 (INR-1481/19/D/B) MIXED RADIATION DOSE EQUIVALENT MEASURING METHODS BASED ON ANALOG DETECTORS. Zielczynski, M. (Institute of Nuclear Research, Warsaw (Poland)). 1973. 121p. (In Polish). INIS.

The basis for elaboration of the methods of radiation dose equivalent measurements is presented. These methods which do not need any analysis of radiation spectrum or its components are assigned mainly to assess the hazard of the workers present in the mixed radiation field of unknown composition. The methods allow the use of analog detectors of various types. The common feature of the detectors is the ability of recording the absorbed energy, the dosimetric equivalency of the soft tissue, and the unequivocal differentiated dependence of their sensitivity upon LET. An appropriate number of such detectors must be used as to the shape of their sensitivity curves. The dose equivalent value is calculated basing on the responses of the detectors. For example the dose equivalent of any radiation is proportional to the difference of the responses of two detectors if one of them has the sensitivity C_1 which doesn't depend on LET and the sensitivity of the other is $C_2 = C_1 (1 + bL)^{-1}$, where L is LET of the radiation and b is a constant. Some methods are discussed in which recombination, scintillation, thermoluminescent and chemical detectors are used. The proceeding in their applications is described and the main experimental characteristics and results are presented. (auth)

14918 (ORNL-TM-4786) 1974 INTERCOMPARISON OF PERSONNEL DOSIMETERS. Dickson, H. W.; Fox, W. F.; Haywood, F. F. (Oak Ridge National Lab., Tenn. (USA)). Jan 1976. Contract W-7405-eng-26. 20p. Dep. NTIS $5.00.

An intercomparison of personnel monitoring dosimeters was conducted at Oak Ridge National Laboratory's DOSAR Facility during the period May 14-16, 1974. Ten independent laboratories and companies participated in an intercomparison of neutron and gamma-ray dosimeters used for routine personnel dosimetry. The dosimeters, which were sent through the mail, were exposed at the Health Physics Research Reactor to the same three "standardized" radiation fields which have been used for the past several years for intercomparing nuclear accident dosimeters. In addition, a 14-MeV neutron field was used as a fourth exposure configuration. The results of the intercomparison show widely varying dose estimates. The average of the reported values of neutron dose equivalent, for example, has standard deviations ranging from 47–102 percent. (auth)

14919 STUDY OF THE CAVITY DISPLACEMENT EFFECT IN "THIMBLE CHAMBERS" USING LiF DOSIMETERS. Fregene, A. O. (Lagos Univ., Nigeria). Radiat. Res.; 64: No. 3, 564-572 (Dec 1975).

A study of the cavity displacement effect has been carried out using LiF rods of diameter 1 mm and length 6 mm. These LiF dosimeters were introduced into different sizes of cylindrical air cavities of length 30 mm each and diameters 30, 20, and 10 mm, respectively. A wide range of radiation energy was covered. A cavity displacement factor of 0.84 ± 0.08 expressing the distance of the effective measuring depth point from the center of the cavity as a fraction of the radius was obtained for x rays and gamma rays. Plots showing the variation of the ratios of the cavity dose to the point cavity dose with cavity size and radiation energy are presented. A table giving the above-mentioned ratio in percentage for a 5 mm cavity diameter at a depth of 5 cm in a polystyrene phantom is also included. Further investigations at 39 MeV electron energy and for other radiation qualities are planned. (auth)

14920 MIXTURE FOR THE SMELTING OF WEATHERING-RESISTANT SILVER-ACTIVATED PHOSPHATE GLASSES FOR DOSEMETERS, ESPECIALLY FOR γ RAYS. Broemer, H.; Kaes, H. H.; Meinert, N.; Preuss, H. J. (to Leitz (E.) G.m.b.H., Wetzlar (F. R. Germany)). German(FRG) Patent 2,039,583/B/. 3 Jan 1974. 4p. (In German)

Silver-activated phosphate glass is used in personnel dosimetry and pulsed dosimetry for the detection of γ radiation. It is smelted from a mixture of 29-44.3% by weight of $LiPO_3$ and 41.5% by weight of $Al(PO_3)_3$ which together have 71-86% by weight, as well as 2-17% by weight of $AgPO_3$, 10% by weight of BeO, and 2% by weight of $NaNO_3$. If $AgPO_3$ is precipitated simultaneously with the $LiPO_3$ in a molar ratio of 1:1, a crude product is formed which can be melted down to transparent glasses. The rise time was optimized, and surface stabilization was achieved even at high temperatures. (DE)

14921 STRAHLENSCHUTZDOSIMETER. Allgemeine Regeln. Entwurf. (Radiation Protection Dosimeter. General. Draft). Berlin, F. R. Germany; Beuth (Nov 1974). 6p. (In German). (DIN-6818(Bl.1)).

3 tabs.

In addition to some definitions (dosemeters, personnel and local dosemeters), the draft standard mainly contains the variables and error sources which may falsify the results of the measurements, as well as general regulations for testing, demands made on control and adjustment of radiation protection dosemeters, and the necessary specifications for the delivery notes of radiation protection dosemeters. (DE)

Nuclear Spectroscopic Instrumentation

Refer also to abstract 15406.

14922 (IFA-MC-23-1975) FORTRAN PROGRAM FOR DATA HANDLING ON PDP-15. Bodo, E. (Institutul de Fizica Atomica, Bucharest (Romania)). [nd]. 8p. Dep. NTIS (US Sales Only) $3.50.

The program TRANS1 enables a more efficient use of DEC tapes by condensing the useful information in the files. In order to obtain the "condensing" the effective data regions are transfered from several files into one. In this way subsequent automatic data processing is facilitated. Two FORTRAN subroutines for the blocking and deblocking of the records in the handled files are used by the program. (2 figures) (auth)

14923 (INIS-mf-1787) MOESSBAUER SPECTROMETER BASED ON A HP2114A COMPUTER. Rochol, J. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Instituto de Fisica). 1972. 77p. (In Portuguese). INIS.

Thesis.

The design and operation of an interface between a Moessbauer experiment and an HP 2114A computer is described. The interface permits simultaneous accumulation of data from two experiments mounted on opposite ends of the same drive. It furnishes a triangular wave at any one of 6 frequencies between 0.5 and 12 Hz and permits accumulating intervals varying from 64 to 1024 channels as well as relative amplification of the velocity scale between the two experiments. Teletype commands have been implemented permitting printout, display or erasing of either or both of the two experimental arrays. The data acquisition and control programs are also presented. (INIS)

14924 (INR-1493/15A/E/B) OPTIMUM FILTERS FOR NUCLEAR SPECTROMETRY. Jaszczuk, J. (Institute of Nuclear Research, Warsaw (Poland)). 1973. 32p. (In Polish). INIS.

The paper contains an analysis of matched filters for spectrometry amplifiers. Theoretical optimum filter and some practical ones are described as well. Based on the results of the analysis the linear amplifier was designed and built. Further research work to be performed on the unstationary, time-variant type of filters is suggested. (auth)

14925 (KIYI-74-30) SPECTROMETER WITH A NARROW NEUTRON BEAM FOR THE MEASURING THE TRANSMISSION OF SMALL SPECIMENS IN THE ENERGY RANGE 0.01 TO 0.3 eV. Razbudej, V. F.; Vertebnyj, V. P. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1974. 8p. (In Russian). INIS.

5 refs.; 3 figs.

A description is given of an operating, time-of-flight spectrometer having a narrow neutron beam 0.17 mm in diameter. A

technique is developed for measuring the transmission of capillary samples having an internal diameter of 0.3 to 0.5 mm with the neutron beam being directed along the axis of the capillary. The spectrometer is equipped to handle experiments involving radioactive samples having an activity up to 0.1 curies. The operating energy range of the spectrometer is 0.01 to 0.3 eV. (tr-SJR)

14926 ELECTRON DETECTOR. Hashimoto, H.; Mogami, A. (to Nihon Denshi Kabushiki Kaisha). US Patent 3,914,606. 21 Oct 1975. Priority date 12 Mar 1973, Japan. 8p.

A device for measuring electron densities at a given energy level in an electron beam or the like having strong background noise, for example, in the detection of Auger electric energy spectrums is described. An electron analyzer passes electrons at the given energy level and at the same time electrons of at least one adjacent energy level. Detecting means associated therewith produce signals indicative of the densities of the electrons at each energy level and combine these signals to produce a signal indicative of the density of the electrons of the given energy level absent background noise. (auth)

14927 CONTINUUM REDUCTION IN THE SPECTRAL RESPONSE OF Ge(Li) PAIR SPECTROMETERS. Robertson, A.; Cormick, G. C.; Kennett, T. J.; Prestwich, W. V. (McMaster Univ., Hamilton, Ontario (Canada). Dept. of Physics). Nucl. Instrum. Methods; 127: No. 3, 373-379(15 Aug 1975).

A system designed to improve the spectral response of Ge(Li) NaI(Tl) triple-coincidence pair spectrometers is presented. The method employed is based upon supression of escaping bremstrahlung and selection of charge-collection times. Results are discussed for the spectra from thermal-neutron capture in nickel and nitrogen. Typically, a factor of 6 improvement in signal to background was achieved in the region of 1.5 to 4 MeV. When the time-discrimination criterion was applied to a single-detector system an average improvement factor of 2.3 was achieved for γ-rays in the same energy range. A quantitative examination of rejected and residual components was conducted for purposes of both identification and characterization of the various spectral constituents. (NL)

14928 A LIQUID-HELIUM NEUTRON POLARIMETER WITH A SIMPLE STRUCTURE AND IN STABLE OPERATION. Katori, K.; Furuno, K. (Tokyo Univ. of Education (Japan). Dept. of Physics). Nucl. Instrum. Methods; 127: No. 3, 381-385(15 Aug 1975).

A neutron polarimeter was constructed for a study of the depolarization of polarized neutrons in neutron-nucleus elastic scattering at $E_n = 1.36$ MeV. The polarimeter consists of a liquid-helium scintillation counter, a spin-precession solenoid, a time-of-flight neutron spectrometer, and a neutron-gamma pulse-shape discriminator. The degrees of neutron polarization in $^{9}Be(\alpha,n_0)^{12}C_{g.s.}$ and $^{12}C(d,n_0)^{13}N_{g.s.}$ reactions were measured as a performance test of the polarimeter. In the time-of-flight spectrum for scattered neutrons with energies as low as 1.36 MeV, the signal-to-background ratio was attained to a factor of 20 or more. (NL)

14929 A RECOIL-PROTON SPECTROMETER USING PULSE-SHAPE DISCRIMINATION IN CsI(Tl). Harihar, P. (Department of Physics and Applied Physics, Lowell University, Lowell, Massachusetts 01854, USA). Nucl. Instrum. Methods; 127: No. 3, 387-390(15 Aug 1975).

A recoil-proton spectrometer using pulse-shape discrimination in CsI(Tl) is described to extend neutron-flux measurements to neutron energies in the kilovolt range. (NL)

14930 A BROAD-RANGE CONVERSION-ELECTRON DETECTION SYSTEM FOR IN-BEAM USE. Gono, Y.; Watson, R. L.; Sugihara, T. T.; Kuebbing, R. A. (Texas Agricultural and Mechanical Univ., College Station (USA). Cyclotron Inst.). Nucl. Instrum. Methods; 127: No. 3, 391-396(15 Aug 1975).

A cooled Si(Li) detector with an electron steering magnet is used to detect internal-conversion electrons from prompt and delayed (particle, xn) reactions. For prompt spectra, the useful electron energy range covered at one current setting is 0.2 to 1 MeV; for delayed spectra the lower limit is about 20 keV. The detection efficiency is 1% for 624 keV electrons and is nearly independent of energy. The resolution is comparable to that of a typical magnetic spectrometer. A prompt in-beam spectrum from the $^{154}Sm(\alpha,4n)^{154}Gd$ reaction and a delayed spectrum from the $^{208}Pb(\alpha,2n)^{210}Po$ reaction are shown. Other applications are discussed. (NL)

14931 RESONANCE SCINTILLATION DETECTOR FOR MOESSBAUER EXPERIMENTS ON THE BASIS OF $Na_2[Sn(OH)_6]$. Gumnerova, L.; Apostolova, M. God. Sofii. Univ., Fiz. Fak.; 65: 383-386(1973). (In Bulgarian).

The use of $Na_2[Sn(OH)_6]$ for the resonance scintillator in the Moessbauer spectrometer is described. The bandwith exp = 0.81 mm/sec for a $BaSnO_3$ source is very good and is smaller than that of a scintillation detector with NaI(Tl). The spectrum of SnO_2 which has a doublet structure is also registered. (Abstr. Bulg. Sci. Lit.)

14932 INSTALLATION FOR THE OBSERVATION OF NUCLEAR GAMMA-RESONANCE ACCORDING TO CONVERSION ELECTRONS. Gruzin, P. L.; Petrikin, Yu. V.; Stukan, R. A. (Moscow Engineering-Physics Inst.). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 716-718(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 48-49(1975).

An experimental installation for performing measurements of Moessbauer spectra with the isolation and registration of conversion electrons in the energy range from one to several tens of kilo-electron-volts is described. Results are presented of the measurements of the electron energy spectra and the resonance spectra of absorbers containing iron. (auth)

14933 MONOCRYSTALLINE QUARTZ NEUTRON FILTER. Efimovich, O. N.; Shapiro, V. G.; Kukhto, O. L. Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 719-720(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 50(1975).

A monocrystalline quartz neutron filter installed before a triaxial neutron spectrometer is described. The dependence of coefficient of neutron flux attenuation in monocrystalline quartz as a function of neutron wavelength is measured at 293 and 85°K in the range 0.3 to 4.9 Å. (auth)

14934 SIMPLE FLIGHT TIME CALIBRATION GENERATOR IN PLL TECHNIQUE. Lauch, J. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (F. R. Germany). Bereich Datenverarbeitung und Elektronik). Kerntechnik; 17: No. 8, 354-358 (Aug 1975). (In English, German)

9 figs.; 1 tab.; 2 refs.

Calibration and routine check-ups of flight time measuring systems can be carried out with the aid of defined flight time calibration spectra. This paper describes a simple flight time calibration generator capable of generating such calibration spectra in the form of line spectra or of a white spectrum. The flight time of the generator is adjustable in steps from 100 to 3,200 ns. The number of calibration lines can be set to 10 to 20, resulting in line spacings ranging from 5 to 320 ns. The stop signals are generated by a crystal oscillator, the start signals are generated by a voltage-controlled oscillator locked in a phase control circuit. The start and stop rates can be adjusted in steps. (DE)

14935 HIGH-RESOLUTION TOROIDAL β SPECTROMETER. Tret'yakov, E. F. (Inst. of Theoretical and Experimental Physics, Moscow). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 3, 102-107(1975).

From 25th all-union conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1975). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 3, 583-590(1975).

High Energy Physics Instrumentation

14936 (CEA-CONF-3087) PROPERTIES OF A SILICA AEROGEL CERENKOV RADIATOR USED IN A COSMIC RAY TELESCOPE. Cantin, M.; Engelmann, J. J.; Koch, L.; Masse, P.; Lund, N.; Byrnak, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91- Gif-sur-Yvette (France). Service d'Electronique Physique). 1975. 5p. INIS.

From 14th international cosmic ray conference; Garching, near Muenchen, F. R. Germany (15 Aug 1975).

A silica aerogel Cherenkov radiator with a refractive index of 1.06 has been flown in a balloon borne cosmic ray telescope. Clear separation of the elements in the iron group was achieved even at high energies. No detectable scintillation component was found. Some optical properties of the silica aerogel used in this flight are presented. (FR)

14937 (CEA-N-1790) SPARK MASS SPECTROMETRY ANALYSIS OF IMPURITIES IN Pu. Billon, J. -P.; Buffereau, M.; Deniaud, S. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92-Montrouge (France)). Jun 1975. 18p. (In French). INIS.

The influence of the physical structure of the sample on the accuracy is pointed out. The consequences on the analytical results obtained by spark source mass spectrometry are given. (FR)

14938 (EFI-74(74)) REGISTRATION THRESHOLD OF TRANSITION RADIATION IN A STREAMER CHAMBER. Shikhlyarov, K. K. (Erevanskij Fizicheskij Inst. (USSR)). 1974. 19p. (In Russian). INIS.

11 refs.; 5 figs.; 2 tables.

The object of this study is both the x ray transition radiation from various radiators and also the possibility of using a streamer chamber attached to the radiator as a detector for particle identification. All measurements were carried out at an electron energy of 3 GeV. With this purpose in mind a determination was made of the threshold for counting quanta of x ray transition radiation in a streamer chamber containing a Xe additive both in the case of deflection of the primary particle (threshold under the track), and also without deflection (threshold above the track). In the first case, which is suitable for investigating x ray transition radiation, it is possible to compare the experimental data with theory. This comparison was carried out for a number of various layer radiators having different parameters. In addition, the data for foamed-layer radiators of different lengths were compared with the results of the spectrometric studies. All the data which were compared were in rather good agreement. In the second case, which is suitable for particle identification, it was possible to confirm the efficiency of isolating photoelectrons on a background of δ electrons. It is shown that at an electron energy of 3 GeV and with a foamed-layer radiator 200 cm in length the distribution of δ-electrons can be discriminated with an efficiency of ~99% with a counting efficiency of ~57% for the primary electrons. (tr-auth)

14939 (EFI-80(74)) REAL TIME FILTERING OF INFORMATION FROM THE CHAMBER FILM MEASURING DEVICE HPD. Vasinyuk, I. E.; Nanasyan, A. S. (Erevanskij Fizicheskij Inst. (USSR)). 1974. 7p. (In Russian). INIS.

4 refs.; 2 figs.

A device is described for filtering the data flux entering a computer from measurement unit HPD. Preliminary scan information, which is written into the computer, serves as the criterion of data selection. From this information the computer assigns zones to the device, in which the transmission of data from HPN is resolved during scanning. By using the method of filtering the information directly during scanning it is possible to reduce the volume of initial data sent to the computer, and correspondingly to increase the efficiency of using the computer and the productivity of the measuring system. (tr-auth)

14940 (INIS-mf-1860) ZERO GUIDANCE MEASUREMENT OF BUBBLE CHAMBER PICTURES. Hertzberger, L. O. (Amsterdam Univ. (Netherlands)). 19 Mar 1975. 110p. INIS.

Thesis.

A description of a fully automatic scanning and measuring system for the processing of photographs from the CERN 2 m hydrogen bubble chamber is given. This system is now successfully used for measuring photographs of a 7.3 GeV/c anti proton experiment. The hardware of the system consists of a Hough Powell Device (HPD) flying spot scanner, a processor (ZGE) specially developed for the purpose, and a CDC 6400 computer. The rolls of film are digitized on the HPD without any preliminary processing. The incoming beam tracks are detected and followed by the ZGE processor simultaneously with the digitizing process. The beamtracks are followed until either an interaction point or the end of the picture is detected. A minimum guidance program FILTER then takes over control, locates the vertex accurately and measures the tracks leaving the interaction point. After the three views of a roll of film have been processed, the measured interaction points are matched in space, and detected events are then passed through the geometrical reconstruction programs. The topology of the events is checked on hand measuring machines, and missing tracks are rescued. (INIS)

14941 (JINR-13-8152) SPECTROMETER FOR TIME-COORDINATE COMPENSATION FOR LARGE SCINTILLATORS. Rikhvitskii, S. V.; Semenyushkin, I. N.; Khrenov, A. N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1974. 16p. (In Russian). INIS.

12 refs.; 6 figs.; 2 tables; submitted to Nucl. Instrum. Methods.

A description is given of a spectrometer with a time-coordinate compensator and a scintillator $120 \times 10 \times 10$ cm^3 in size for determining the coordinates and flight time of particles. Formulas are presented for calculating the accuracy of the spectrometer. A spatial resolution of 3.6 cm and a time-of-flight resolution of 560 psec are obtained in a beam of π^--mesons having a momentum of 4 GeV/c. (tr-auth)

14942 CHERENKOV SPECTROMETERS WITH A HIGH TIME RESOLUTION. Adishchev, Yu. N.; Dudkin, G. N.; Eponeshnikov, V. N.; Krechetov, Yu. V. (Scientific-Research Inst. of Nuclear Physics, Electronics, and Automation, Tomsk, USSR). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 714-715(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 46-47(1975).

The time and spectrometric characteristics of TF-1 and KRS-6 Cherenkov total-absorption spectrometers with radiators were investigated using a monochromatic electron beam of a pair magnetic γ spectrometer. In the energy range 200 to 600 MeV an energy resolution of 25 to 15% was obtained for TF-1 and 24-14% for KRS-6; a time resolution of $2\tau \approx 2$ to 3.5 nsec was obtained for both TF-1 and KRS-6. The time shift was < 0.5 nsec in the 100 to 800 MeV energy range. The effect of the reflecting radiator coating on the time and spectrometric characteristics was investigated. (auth)

14943 P-V-T DIAGRAM OF LIQUID PARAHYDROGEN IN THE METASTABLE REGION. D'yachkov, E. I. (Joint Inst. for Nuclear Research, Dubna, USSR). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 721-722(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 51-52(1975).

The p-v-T diagram of liquid hydrogen in the metastable state is presented. Isotherms and isoentropes are calculated with the Van der Waals equation with variable coefficients a' and b'. The calculated isoentropes of the diagram are close to experimental values. The threshold of sensitivity of relativistic particles found in a 100-cm hydrogen bubble chamber is given. (auth)

14944 DEPENDENCE OF IONIZATION OF MOMENTUM OF RELATIVISTIC PARTICLES IN NUCLEAR PHOTOEMULSIONS. Chasnikov, I. Ya.; Shakhova, Ts. I. (Inst. of High-Energy Physics, Alma-Ata, USSR). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 723-725(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 52-54(1975).

Ionization (bunch density) measurement results are analyzed for primary- and secondary-particle tracks in nuclear photoemulsions, produced in accelerators at the JINR (Dubna), IHEP (Serpukhov), and FNAL (Batavia). The relativistic growth in ionization is given as a function of emulsion sensitivity. The conditions for reliable identification of fast particles are found. (auth)

14945 TIME-OF-FLIGHT SCINTILLATION TELESCOPE. Voronov, S. A.; Kustovskii, A. F. (Moscow Engineering Physics Inst.). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 735-736(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 62-63(1975).

A method for separating relativistic particles by directions is described; it makes use of two scintillation counters with a base distance of 0.5 m. The "forward" to "reverse" efficiency ratio for particle recording is >100. (auth)

14946 POSTDISCHARGE DEIONIZATION IN SPARK CHAMBERS WITH A SMALL GAP. Martynov, V. I.; Ryl'tsov, V. V. (Inst. of Theoretical and Experimental Physics, Moscow). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 747-749 (1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 72-74(1975).

The recovery of the pulse electrical strength of spark chambers for two values of interelectrode gap (1.0 and 0.6 cm) was investigated in relation to the electric conditions and composition of the gas mixture. The spark chambers were filled with Ne + He, Ne, and He at atmospheric pressure with the addition of a few percent ethanol vapor, isopropanol vapor, and 0.01% Freon-12. The recovery time is determined largely by the drift time of the ion column and the concomitant secondary processes on the electrodes and in the gas volume. (auth)

Radiometric Instruments

14947 (AEC-tr-7315, pp 56-61) EXPERIMENTAL INVESTIGATIONS ON THE PROBABILITY DISTRIBUTION OF THE OUTPUT SIGNAL OF THE INTEGRATOR. Kreindlin, I. L.; Savitsku, L. G.; Skoblo, Yu. A. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

Radioisotope relay equipments (RRE) have received wide application in the different branches of the national economy. However, in the majority of cases, radioactive sources of exaggerated activity are used due to the absence of systematic investigations on the statistical character of disintegration of the radioactive sources. Besides, some fine but feasible problems remain unsolved for the same reason. The results of the experimental investigations on the distribution of the output signal of integrator are presented. The following was determined in the experiments: the probability density function of the output signal of the integrator, the number of overshootings of the output signal for the given level, and the average time interval (To) between the false responses at To much greater than tau (tau is the time constant of the integrator). (auth)

14948 (AEC-tr-7315, pp 61-70) DATA UNIT OF A beta-THICKNESS GAUGE OF COATINGS. Pravikov, A. A. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

The amount of registered back scattered electrons in the irradiation of controlled articles with a beta-particle beam depends substantially on the dimensions of the elements of the data unit. The least systematic error of measurement of thicknesses of coatings on small surface areas due to change of the distance between the detector and the controlled article can be obtained in the case of absence of rigid fixation of the value of the controlled surface. Considerations applied to this case are given for the choice of the distance between the detector and the controlled article, the depth of the collimator, and the diameter of the collimating orifice. The required activity of the beta-radiation source is calculated. Requirements are presented for the specific activity of the source as a function of the surface of control. Finally, a data-unit prototype is described, which enables measurements on a surface of 10 mm^2. (auth)

14949 (AEC-tr-7315, pp 70-75) SOME CHARACTERISTICS OF THE RADIOISOTOPE ABSORPTION METHOD FOR THE MEASUREMENT OF GAS PRESSURES. Mashinin, V. A.; Pelenitsyn, N. N.; Rogozhin, O. V. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

Quick-response methods of measuring gas pressures are necessary for the solution of many research and technical problems. The possibility for the creation of a quick-acting radioisotope manometer, based on the absorption and scattering of alpha-particles by a gaseous medium, is investigated. (WHK)

14950 (AEC-tr-7315, pp 100-108) EFFECT OF INSTRUMENTAL INSTABILITIES ON THE EXPLOITATION PARAMETERS OF RADIOISOTOPE RELAY EQUIPMENT. Kreindlin, I. I. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

The determination of the exploitation characteristics and potentialities of radioisotope relay equipment (RRE), as applied to the solution of concrete problems, as a function of the instrumental and electrical parameters of the equipment, is one of the important questions. Expressions have been obtained which relate the exploitation statistical reliability in the conditions of operation and slackening T_1 and To, the quick action t_{01} and t_{10}, the value of the drop 'K', the required counting velocity n_1 and n_0, and consequently the activity of the radiation source, with the time constant of the detector 'tau' the effectiveness of the detector, and the necessary established threshold values of the apparatus n_{01} and n_{10}. The relations between the different parameters were obtained without the consideration of the possible instabilities of the following basic sub-assemblies of the RRE: detector, amplifier, pulse shaper, integrator and threshold cascade. These instabilities are expressed as the change of the calculated established threshold quantities n_{01} and n_{10} by some values DELTA n_{01} and DELTA n_{10} respectively. (auth)

14951 (AEC-tr-7315, pp 196-201) RADIOISOTOPE SCINTILLATION LEVEL GAUGE: REGULATOR RSUR-1. Kreindlin, I. I.; Kolyada, A. N.; Pakhynkov, Yu. I. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

The radioisotope scintillation level gauge-regulator RSUR-1, intended for continuous remote measurement of the level of liquids (for example, nitric acid in an autoclave) and the admission of a control signal in the system of automatic control is described. The apparatus consists of the gamma radiation source block BIIP-1 and the scintillation detector GDS-1 which are stationed on the opposite sides of the reservoir, the electronic block, and the electronic automatic self-recording potentiometer EPP-09M3-3 which has a pneumatic isodromic regulating mechanism. (WHK)

14952 (AEC-tr-7315, pp 201-207) UNIVERSAL RADIOISOTOPE RELAY APPARATUS RTR-1. Kreindlin, I. I.; Skoblo, Yu. A.; Khakhalin, V. V. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

The functional circuit and the construction of the universal radioisotope relay apparatus RTR-1 are given. (WHK)

14953 (BNL-20718) INSTRUMENT FOR BONE MINERAL MEASUREMENT USING A MICROPROCESSOR AS THE CONTROL AND ARITHMETIC ELEMENT. Alberi, J. L.; Hardy, W. H. II. (Brookhaven National Lab., Upton, N. Y. (USA)). Nov 1975. 8p. (CONF-751116-23). Dep. NTIS $3.50.

From nuclear science symposium; San Francisco, California, USA (17 Nov 1975).

A self-contained instrument for the determination of bone mineral content by photon absorptometry is described. A high-resolution detection system allows measurements to be made at up to 16 photon energies. Control and arithmetic functions are performed by a microprocessor. Analysis capability and limitations are discussed. (auth)

14954 (FRNC-TH-566) NEUTRONIC METHOD OF SOIL MOISTURE MEASUREMENT. Couchat, P. (Toulouse-3 Univ., 31 (France)). 1974. 123p. (In French). INIS.

The neutronic method is first outlined: analysis of neutron-nucleus interaction phenomena shows that the neutronic parameters of damp soils depend on the water itself, then on the dry density and the total chemical composition. A physical model representing the neutron moisture gage is worked out next, which leads to the establishment of a simple new mathematical expression applicable to two-dimensional geometry using the multigroup theory diffusion approximation. Following a brief description of the principle and technology of moisture gages two essential problems are dealt with: the calibration curve established by a quick and reliable method involving direct measurement of the thermal neutron constants of soils, and the measurement volume which must be approached by the use of a two-dimensional physical model to describe the geometrical conditions correctly. The problem of the vertical and horizontal resolution power of the neutron probe and the limiting case of surface measurements are discussed. Some possibilities offered by epithermal and fast neutron detection are suggested: epicadmic information represents a step forward as a complement to the thermal measurement since it supplies the principle of a moisture-gage independent of the dry density and allows the calibration curves of conventional instruments to be determined in situ. An experimental study of fast neutron space-energy distribution is described, extended, and specified by a physical model constructed on a Monte Carlo code; this gives the basis of a technique to measure water contents by fast neutron transmission. (FR)

14955 (FRNC-TH-566(APP.)) NEUTRONIC METHOD OF SOIL MOISTURE MEASUREMENT. Appendix. Couchat, P. (Toulouse-3 Univ., 31 (France)). 1974. 83p. (In French). INIS.

In this appendix are assembled figures which shed light on the main text but are not indispensable and notes on some particular aspects of the neutronic method. (FR)

14956 (IFTJ-66/E) MEASURING ASSEMBLY FOR THE DETERMINATION OF THE SETTLING VELOCITY OF SOLID PARTICLES IN SUSPENSIONS. Krasowski, R.; Wolski, K. (Institute of Physics and Nuclear Techniques, Krakow (Poland)). 1975. 16p. (In Polish). Dep. NTIS (US Sales Only) $3.50.

An assembly designed for the research of the sedimentation phenomenon in suspensions, by means of radioactive tracers is described. The assembly renders possible to record the corresponding activity peaks in both analog and digital forms. The paper gives the details on the construction and operation of particular units of the assembly as well as on its technical performance. (auth)

14957 (IFTJ-68/E) COUNTS-RATIO METER TYPE RI-2-74. Gaczol, R.; Krasowski, R.; Palka, K. W.; Tota-Ramisz, E. (Institute of Physics and Nuclear Techniques, Krakow (Poland)). 1975. 22p. (In Polish). Dep. NTIS (US Sales Only) $3.50.

The paper describes the digital instrument for measuring the ratio of counting derived from two-detector radiometric probes for density and moisture measurements of soils. The instrument can also be used as a scalar associated with different kinds of probes being applied in well logging. (auth)

14958 APPARATUS FOR MEASUREMENT OF TREE CORE DENSITY. Blincow, D. W. (to Tyco Labs., Inc.). US Patent 3,919,551. 11 Nov 1975. Filed date 14 Mar 1974. 4p.

Apparatus is described for direct measurement of the density of a core sample from a tree. A radiation source and detector with a receptacle for the core therebetween, an integrator unit for the detector output, and an indicating meter driven by the integrator unit are described. (auth)

14959 DEPTH PROFILE ANALYSIS APPARATUS. Valentine, A.; Goff, R. F. (to Minnesota Mining and Manufacturing Co.) US Patent 3,916,190. 28 Oct 1975. Filed date 1 Mar 1974. 10p.

An apparatus and method for depth profile analysis is described in which atoms are removed from a surface by sputtering thereby forming a crater from successively exposed portions of a solid, which portions are then elementally analyzed. The improvement of the present invention comprises deflecting a primary ion beam across the surface to form a crater extending about a predetermined region of the surface and enabling the production of a signal indicative of surface atoms of a given mass only when the primary ion beam is impinging upon a smaller portion of the predetermined region, thereby ensuring that the signal is representative of atoms within the smaller portion, such as at the bottom of the crater. (auth)

14960 MEASUREMENT OF ABSORPTION OF RADIATION. Hornby, M. R.; Tunstall, D. F. (to British Titan Ltd.). US Patent 3,914,604. 21 Oct 1975. Priority date 20 May 1972, United Kingdom of Great Britain and Northern Ireland (UK). 10p.

A method for the determination of particle size distribution is described in which a beam of electromagnetic radiation is passed through a liquid containing the powder while it settles due to the action of centrifugal force with the beam having a thickness in a radial direction d such that d/r is not greater than 0.2 and in which r is the depth of the beam from the liquid surface and where r/R is not greater than 0.1 where R is the radius of the inner surface of the liquid. Apparatus for use in the determination of particle size distribution as described comprising a disc centrifuge having an annular chamber to retain the powder dispersion under test, a source of electromagnetic radiation, means to define a beam of the radiation, detector means and means to move the disc relative to the beam are discussed. (auth)

14961 PROCESS AND DEVICE FOR DETERMINING THE POROSITY AND SALINITY OF FORMATION WATER. Nelligan, W. B. (to Societe de Prospection Electrique Schlumberger). French Patent 2,228,227/A/. 29 Apr 1974. 29p. (In French)

The formation is irradiated by pulsed neutrons and the resulting neutron population is observed at two spaced emplacements. An absorption characteristic is determined in one of the emplacements and the ratio of the neutron populations to the two emplacements is evaluated. These values are then graphed and used to determine the apparent values of the porosity and salinity of the water. This allows an estimation of the water saturation. The invention is used chiefly for the study of petroleum formations crossed by a tube probe. (tr-FR)

14962 ALPHA-IONIZATION GAS ANALYZER FOR THE DETECTION OF AIR IN HYDROGEN AND DEUTERIUM AT ATMOSPHERIC PRESSURE. Mitrofanov, A. V. (Inst. of Physical Problems, Moscow). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 750-751(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 75-76(1975).

A gas analyzer based on a PMR-2 radioactive pressure transducer with a plutonium source for measurement of the amount of air in H_2 or D_2 in the range 0 to 30% to within 0.3% is described. The proposed device is suitable for testing the explosive hazard of H_2 or D_2 contained in rubber envelopes. (auth)

14963 SELEKTIVNYI GAMMA-GAMMA KAROTAZH NA UGOL'NYKH MESTOROZHDENIYAKH. (Selective Gamma-Gamma Logging in Coal Deposits). Utkin, V. I. Moscow; Izdatel'stvo Nauka (1975). 127p.

Theoretical and experimental bases of the selective gamma-gamma logging method are examined, and the features of the use of this method in coal deposits are considered. The results of study of the spectra of gamma radiation dispersion in media with low (less than 13) effective atomic numbers are presented. Measurement probes and their calibration are considered in detail. Information from borehole tests of the method is discussed, and the data are analyzed from the viewpoint of identification of coal strata, determination of their structure and ash content, and the possibility of conversion to a penetration-free examination of boreholes in final prospecting and location of coal deposits. (tr-auth)

14964 POSITRON ANNIHILATION PROBING FOR THE HYDRATION RATE OF CEMENT PASTE. Myllylae, R.; Karras, M. (Oulu Univ. (Finland). Inst. of Nuclear Technology). Appl. Phys.; 7: No. 4, 303-306(Aug 1975).

5 figs.; 7 refs.

Positron annihilation has been found to be a possible probe for the exponential hydratation of cement paste. Both lifetime and Doppler line broadening measurements revealed the hydratation rate. With the aid of increased stability in the lifetime spectrometer it has been possible to extend the measuring sensitivity over a period of several weeks. Two main lifetimes, $\tau_1 = 480 \pm 20$ psec and $\tau_2 = 2.1 \pm 0.1$ nsec, were observed to be constant during the hydratation. The intensity of the 2.1 nsec component changed from 4 to 8% after 47 days, and simultaneously the annihilation line narrowed from 2.6 to 2.4 keV. This behavior has been interpreted as an increase in positronium formation. The possible practical applications of positron annihilation radiation as a hydratation probe has been evaluated for use in a concrete laboratory and even for regular construction work. (DE)

14965 VERSATILE IN-DEPTH ANALYZER. Wittmaack, K.; Maul, J.; Schulz, F. (Gesellschaft fuer Strahlen- u. Umweltforschung mbH, Nuremberg). pp 164-176 of Electron and Ion Beam Science and Technology. Bakish, R. (ed.). Princeton, NJ; Electrochemical Society, Inc. (1974).

From 6th international conference on electron and ion beam science and technology; San Francisco, California, USA (12 May 1974). See CONF-740515-.

The characteristics of a high sensitivity in-depth analyzer are presented. The system is built in a differentially pumped ultra-high vacuum version to reduce possible interference with impurities from residual gases. The primary ion beam with an energy of up to 15 keV is supplied by a triode ion gun which is capable to produce beams with constant current density across a 5 mm spot. Either argon or oxygen ions are used for sputtering. Charge neutralization in case of insulating specimens is achieved by means of a low energy electron gun. Small area analysis can be accomplished by use of an additional single lens. The mass spectrometer consists of an aperture bounded plate capacitor for suppression of noise producing secondaries followed by a quadrupole mass filter. Improved detection sensitivity by up to a factor of 100 in comparison with a previous design is achieved using the energy filter as an acceldecel system for the secondary ions (acceleration voltage approximately 100 V). Optimum operation of the quadrupole analyzer in secondary ion mass spectrometry is discussed. (auth)

14966 METHOD AND EQUIPMENT OF LINEARIZATION AND CONTROL OF THE GAIN IN A NUCLEAR BOREHOLE LOGGING SYSTEM. Jones, J. M. (to Texaco Development Corp.). German (FRG) Patent 2,344,172/A/. 6 Mar 1975. 25p. (In German).

1 fig.

The method and the equipment for control of the gain and the linearity which corrects the detector system of the probe and the surface electronics of a borehole logging system for gamma radiating energy measurements in the case of non-linearities due to measuring cables are described. The gamma radiating pulses are conducted to the control circuit of the gain which controls a ratio of counting runs. These counting runs are in at least two given energy regions of the gamma radiation energy spectrum of the underground formation. After calibration, the two energy regions of the control circuit are used for developing a field signal which is proportional to the difference of each gain drift. It is used in a feedback manner for the compensation of the detector feeding voltage and/or for the control of amplification of the signal above ground. (DE)

14967 EFFECTS OF AMBIENT CONDITIONS ON THICKNESS GAUGING OF PAPER BY RADIOISOTOPES. Bedair, S. M. (Alexandria Univ. (Egypt). Inst. of Nuclear Engineering); El-Saiedi, A. F.; Abdel Rahman, F. M. (Atomic Energy Establishment, Cairo (Egypt)). Atomkernenergie; 26: No. 2, 129-132(1975).

9 figs.; 4 refs.

Changing the ambient conditions such as humidity and temperature was found to affect appreciably the mass thickness gauging of paper by radioisotopes. This investigation is an analytical and experimental study of such effects. A formula is presented giving the percentage error in the gauging process as a function of the mass thickness of paper and the surrounding air conditions. An experimental testing chamber was designed to provide possibilities of changing either or both temperature and relative humidity of the surrounding air. Temperatures in this investigation were varied from 20° to 70°C and relative humidity from 10 to 100%. A rather good agreement has been found between the theoretical and experimental estimation of the percentage error. Such error was found to range from positive to negative values according to the ambient conditions. (DE)

14968 RADIOMETRIC METHODS FOR LEVEL MEASUREMENTS. Heier, K. (Laboratorium Prof. Dr. Berthold, Wildbad (F.R. Germany)). Verfahrenstechnik (Mainz); 9: No. 7, 339-343(Jul 1975). (In German).

From meeting on level measuring technology; Duesseldorf, F.R. Germany (10 Apr 1975). 10 figs.

Radiometric methods of measurement have the advantage of independence from the chemical and most of the physical properties of the charge and of measurement without contact. Different methods of quantitative level measurement are presented; the best results are achieved by dielectric rod radiators. The solution of complicated problems of measurement is shown by example. Radiator and shielding for limit-level switching systems can be calculated using only a few equations. (DE)

Radiation Effects on Instrument Components, Instruments, or Electronic Systems

14969 (AD/A-005084) ADVANCED ELECTRO-OPTICAL SYSTEM HARDENING. Phase II. Computer-Aided Suscep-

tibility Analysis of the Host Sensor Amplifier to IEMP. Final Report. Gilbert, J. L. (General Research Corp., McLean, Va. (USA)). Dec 1974. Contract DAAG39-73-C-0047. 40p. NTIS $3.75.

The study examines the vulnerability of one channel of the HOST detector amplifier to internal electromagnetic pulse (IEMP) induced transients coupling into the circuit at certain selected locations. Only the effects of the induced transients on the circuit, including transient-radiation effects on electronics (TREE) effects, are studied, not the IEMP coupling modes. The entry points for the transients are assumed to be cables interconnecting the various subcircuits composing the amplifier. The circuit operation was simulated using the NET-2 network analysis computer program. In the simulation, models were used which incorporated both linear and nonlinear characteristics. The induced transients were simulated using current pulses 1 sq microsec. HDL experimental component failure data for 1-microsec pulses were used for circuit component failure criteria. (GRA)

14970 (CERN-75-18) RADIATION DAMAGE TO ELECTRONIC COMPONENTS. Battisti, S.; Bossart, R.; Schoenbacher, H.; Van de Voorde, M. (European Organization for Nuclear Research, Geneva (Switzerland)). 19 Dec 1975. 32p. Dep. NTIS (US Sales Only) $4.00.

Characteristic properties are presented of some 40 different electronic components (resistors, capacitors, diodes, transistors, and integrated circuits) which were irradiated in a nuclear reactor up to 10^{15} n/cm^2 (E > 1 MeV). Complete circuits (e.g. RF amplifiers and detectors, mixers, differential amplifiers, voltage-to-frequency converters, oscillators, power supplies) were irradiated near the CERN Intersecting Storage Rings up to 10^6 rad(RPL) (does measured with radiophotoluminescent dosimeters) under simulated operational conditions. Representative measured parameters, such as resistance, capacitance, forward voltage, reverse current, toggle frequencies, are given in graphs as a function of radiation dose. The results are discussed in detail and lead to the over-all conclusion that the operation of electronic components and circuits is seriously affected by radiation environments with doses in the order of 10^{13} n/cm^2 or 10^4 rad (RPL); some components and circuits fail completely at doses at 10^{14} n/cm^2 or 10^5 rad(RPL). (auth)

14971 (PEM-30) NUCLEAR EMP: BULK CURRENT IN AN INSULATED CABLE LYING ON THE SURFACE OF THE EARTH. Brown, G. L. (Resource Engineering and Planning, Huntsville, Ala. (USA)). Feb 1975. 18p. Dep. NTIS $4.50.

This note is concerned with the problem of predicting the bulk current that will be generated in an insulated cable, lying on the surface of the earth, by an EMP field. The point of departure for developing a solution to the problem is a set of differential equations developed by E. D. Sunde. The work done by Putzer, Brown and Schwartz in obtaining a solution for the currents in the terminal loads of such a cable is summarized. This note also presents the derivation of some simplified equations for estimating the maximum current that could be generated in a surface cable by an EMP. Such an estimate is useful in determining how much EMP protection to apply. The derivation consists of making a series of approximations and assumptions. A comparison is made of predicted maximum values of bulk current and the currents measured in actual system cables. Although the predictions are valid for all of the small amount of test data available, more comparisons should be made between predicted and measured currents to verify the usefulness of the equations. (auth)

14972 (PEM-33) NUCLEAR EMP: VOLTAGE CLAMPING LEVELS FOR SEVERAL TRANSZORB TRANSIENT SUPPRESSION DEVICES. Clark, O. M. (General Semiconductor Industries, Inc., Tempe, Ariz. (USA)). Mar 1975. 8p. Dep. NTIS $4.50.

Voltage clamping levels for the 1N5629A, 1N5545A, 1N5654A, and 1N5664A TransZorb/sup T.M./ silicon transient-suppression devices in a DO-13 package are presented as data in photographs of test waveforms. A graph is compiled which illustrates the clamping voltage at a time point of 80 nsec for each of the devices. The duration of the test pulse was 250 nsec with a slope of 4 kV per nsec for the rise portion. Clamping levels are nearly constant for test current amplitudes of up to 120 A. (auth)

14973 (PEM-34) NUCLEAR EMP: TRANSIENT CURRENT ESTIMATES FOR FINITE LENGTH SURFACE CABLES. Wilson, M. R. (Mission Research Corp., Albuquerque, N. Mex. (USA)). Feb 1975. 30p. Dep. NTIS $5.00.

A finite length insulated wire lying at the earth-air interface is modeled using a transmission line approach. Transient response to a double exponential incident pulse with 10 ns rise time is obtained for various incident polarizations, cable lengths, soil conductivities and termination impedances. Characterizing all cases, the induced current pulses peak at approximately (3 to 20) amps/kv with rise time approximately (.1 to .2) mu sec. A simple bare wire surface cable model current estimate is shown to be in good agreement with results from a more sophisticated model of a wire near the ground plane. (auth)

14974 (PEM-38) NUCLEAR EMP: KEY SUPPRESSION DEVICE PARAMETERS FOR EMP HARDENING. Durgin, D. L.; Brown, R. M. (Braddock, Dunn and McDonald, Inc., Albuquerque, N. Mex. (USA)). Mar 1975. 20p. Dep. NTIS $4.50.

The electrical transients induced by EMP exhibit unique characteristics which differ considerably from transients associated with other phenomena such as lightning, switching, and circuit malfunctions. The suppression techniques developed to handle more common transients, though not necessarily the same devices, can be used for EMP damage protection. The suppression devices used for circuit level EMP protection are referred to as Terminal Protection Devices (TPD). Little detailed data describing the response of TPD's to EMP-related transients have been published. While most vendors publish specifications for TPD performance, there is little standardization of parameters and TPD response models are not available. This lack of parameter standardization has resulted in a proliferation of test data that is sometimes conflicting and often not directly comparable. This paper derives and/or defines a consistent set of parameters based on EMP circuit hardening requirements and on measurable component parameters and is concerned only with use of TPD's to prevent permanent damage. Three sets of parameters pertaining to pertinent TPD functional characteristics were defined as follows: standby parameters, protection parameters, and failure parameters. These parameters are used to evaluate a representative sample of TPD's and the results are presented in matrix form to facilitate the selection of devices for specific hardening problems. (auth)

14975 RADIATION HARDENED SENSE AMPLIFIER FOR THIN FILM MEMORY APPLICATIONS. Grundy, G. L.; Steiner, D. C.; Gutzmann, G. C.; Krueger, R. G. (to Secretary of the Air Force). US Patent 3,909,739. 30 Sep 1975. Filed date 27 May 1969. 6p.

An apparatus for a radiation hardened sense amplifier for operation in a radiation environment having a plurality of amplifier stages of the Darlington pair type utilizing transformer coupling is described. The first stage includes a common mode choke to provide a photo-current cancelling function while the Darlington pair in each amplifier stage provides a gain stabilization function. (auth)

Miscellaneous Instruments

Refer also to abstracts 16288, 16349, and 16425.

14976 (CEA-CONF-2938) MANUFACTURE, TESTING AND IN-PILE USE OF HIGH TEMPERATURE THERMOCOUPLES. Schley, R.; Liermann, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91- Gif-sur-Yvette (France). Dept. de Technologie). 1974. 12p. (In French). INIS.

From international colloquium on high-temperature in-pile thermometry; Petten, Netherlands (12 Dec 1974).

The manufacture of tungsten rhenium and Chromel Alumel thermocouples based on a method in which strict standards of purity and cleanliness are applied to the components is described. Certain technical arrangements of the assemblies offset the disadvantages caused by the brittleness of tungsten rhenium alloys. Appropriate testing methods are used to check the quality of the products obtained. The in-pile use of such thermocouples is described and their degree of reliability determined. The results obtained and drawn from information post-irradiation examinations are summed up. (FR)

14977 (FRNC-TH-545) NEW OBSERVATION METHODS FOR THE NUCLEAR MAGNETIC RESONANCE. Delayre, J. (Grenoble-1 Univ., 38 (France)). 1975. 182p. (In French). INIS.

Following a brief account of the properties of linear filters the problems and application of an NMR experiment with stochastic excitation are examined. A new method known as "modulated-pulse excitation", by which very broad spectra may be observed without increasing the peak power of the excitation pulse, is described. The various methods of obtaining an NMR spectrum are compared from both the theoretical and experimental viewpoints. Stochastic excitation appears to be the best excitation

method, its main advantages being the low power needed for irradiation and the possibility of generating spectra at will (elimination or decoupling of a line) with the modulated pulse, an extension of the pure pulsed method. Any power problems inherent to very high field spectrometers and to NMR of solids can be solved both for observation and for decoupling. (FR)

14978 (IFTJ-69/E) WANG 700 MINICOMPUTER INTERFACE TYPE 700/H. Wolski, K. (Institute of Physics and Nuclear Techniques, Krakow (Poland)). 1975. 14p. (In Polish). Dep. NTIS (US Sales Only) $3.50.

The Interface 700/H described is designed especially for data transfer from the multichannel pulse-height analyzer of the Hungarian NTA family, as well as from the punched paper tape reader "READMOM", to the WANG minicomputers of the series 700. The principle of operation of the interface and basic technical parameters of the interfaced devices are presented. (auth)

14979 DESIGN FOR A CONVENTIONAL HIGH-RESOLUTION NEUTRON POWDER DIFFRACTOMETER. Hewat, A. W. (Institut Max von Laue–Paul Langevin, 38-Grenoble (France)). Nucl. Instrum. Methods; 127: No. 3, 361-370(15 Aug 1975).

The design considerations for a conventional neutron powder diffractometer are reconsidered. It is found that the resolution can be improved to the limits imposed by the powder particle size, while the effective intensity can at the same time be increased by using multiple counters with the correct combination of soller divergences, monochromator mosaic spread, and take-off angle. With the profile technique for data analysis, this high resolution diffractometer should permit the refinement of nuclear and magnetic structures having unit cells of up to 3500 A^3 volume. (NL)

14980 HIGH PERFORMANCE CURRENT GENERATOR WITH ONE-PICOAMPERE RESOLUTION. Grillo, L.; Manfredi, P. F.; Marchesini, R. (Istituto Nazionale di Fisica Nucleare, Milan (Italy)). Nucl. Instrum. Methods; 127: No. 3, 435-440(15 Aug 1975).

A high-performance current generator for the picoampere region is presented. Although it was primarily developed as a part of an automatic test system to calibrate charge integrators for accelerating machines. It can suit a wide range of applications. It consists basically of a positive feedback loop of controlled gain which includes a varactor bridge operational amplifier. The essential features of the instrument are a 1 pA resolution and a 10^{15} Ω output impedance. The output is guarded and floating between −120 V and +120 V, and the voltage across the external loads is measured without affecting the delivered current by a digital panel meter on the front panel. The unit can therefore operate as a high-accuracy dc impedance meter. (NL)

14981 PULSE SUBTRACTOR USING INTEGRATED MICROCIRCUITS. Natanzon, D. D. (Inst. of Biophysics Ministry of Health, Moscow). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 787-789(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 103-105(1975).

A high-speed pulse-subtraction circuit has been developed for background radiation in which the apparatus expense has been minimized. A differential counting circuit was assembled using 12 packages of type 217 integrated microcircuits which have a resolving time of 230 nsec and a counting capacity m = 7 bit. It is possible to obtain higher capacity by connecting such circuits in series, and in this case $m = 8^k - 1$, where k is the number of circuits connected. (auth)

14982 APPLICATION OF THE CAMAC SYSTEM IN LABORATORY RESEARCH, INDUSTRY, AND MEDICINE. Kolpakov, I. F.; Khmelewski, E. (Joint Inst. of Nuclear Research, Dubna, USSR). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 665-676(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 7-18(1975).

A review is given of the report to the First International Symposium on the Application of the CAMAC System in Real Time, which was held in Luxembourg from December 4 through 6, 1973. Consideration is given to the application of the CAMAC system in physics and other scientific laboratories, for control in industry, and in medicobiological research. (auth)

14983 APPARATUS FOR THE STUDY OF THE KINETICS OF THE DESTRUCTION OF SUPERCONDUCTIVITY BY A CURRENT. Posada, E.; Robin, D.; Rinderer, L. (Lausanne Univ., Switzerland). Cryogenics; 15: No. 9, 513-516(Sep 1975).

An apparatus suitable for the study of the kinetic aspects of the destruction of superconductivity by a current is described. It includes a fast, high capacity (100 A) current amplifier, low level sampling circuits for the simultaneous measurement of the current and of the voltage across the sample, a simple analogue divider for directly recording the resistance–current curves, and the necessary synchronizing circuits. (auth)

ISOTOPE AND RADIATION SOURCE TECHNOLOGY

14984 RADIOIODINE-123 FOR MEDICAL RESEARCH AND DIAGNOSIS. Myers, W. G. pp 131-160 of Recent Advances in Nuclear Medicine. Vol. IV. Lawrence, J. H. (ed.). New York; Grune and Stratton, Inc. (1974).

The physical properties, production, and use of ^{123}I in medical research and diagnosis are summarized. Its physical properties, including short half-life and absence of high-energy, short-range beta particles makes it particularly desirable for nuclear medical purposes. Although the energy emission range is ideal for scanning purposes, the radiation dose to the patient is greatly reduced over that of ^{131}I thus allowing the use of ^{123}I in pregnancy or in children or at more frequent intervals in all patients. (ERB)

Isotope Separation (Industrial)

Refer also to abstracts 14366 and 14717.

14985 (COO-2569-1) LUMINESCENCE PROCESS, REFRACTORY STABILITIES, AND NEW AND NOVEL ELECTRONIC STATES: SCANNING CHEMICAL REACTIONS AND NOVEL PRODUCTS FOR LASER INDUCED ISOTOPE SEPARATION. Progress Report, March 1, 1975–November 20, 1975. Gole, J. L. (Massachusetts Inst. of Tech., Cambridge (USA)). Nov 1975. Contract E(11-1)-2569. 27p. Dep. NTIS $4.00.

The formulation and development of versatile oven systems for high temperature metal vaporation at temperatures greater than 2000^{0}C are discussed. The construction of an apparatus appropriate to the production and study of small metal aggregates M/sub n/ (2 less than or equal to n less than or equal to 6) is discussed at length. This includes a consideration of the construction and operation of an argon ion pumped dye laser system. The dye laser system will be used to induce fluorescence from the small metal aggregates, and thereby will lead to the study of their molecular electronic structure. The production of carbon vapor and the reaction of this vapor with metal atoms and metal dimers to form metal carbides is outlined. A thorough study of the luminescence process leading to a new understanding of those chemiluminescent phenomena occurring as a result of the "single collision" bimolecular reaction of metal atoms and metal dimers with select oxidants is outlined. Methods for the determination of upper bounds to the heats of sublimation and vaporization of those metals which can be strongly oxidized in a "single collision" bimolecular reaction are presented. Extremely simple methods by which one can infer the radiative lifetimes of metastable product chemiluminescing molecules are also discussed. Beginning efforts toward the formulation of new and novel catalytic surfaces via aggregate deposition are outlined. Current studies of the titanium oxide system are presented. These chemiluminescence studies allow the determination of a lower bound to the TiO dissociation energy and a determination of the heat of vaporization of titanium metal. (auth)

14986 (INIS-mf-1825) SOUTH AFRICAN URANIUM ENRICHMENT PROJECT. Roux, A. J. A.; Grant, W. L. (Atomic Energy Board, Pelindaba, Pretoria (South Africa)). 1975. 14p. INIS.

From European Nuclear Conference; Paris, France (22 Apr 1975).

Pelevant aspects of the South African uranium enrichment project are briefly outlined as they were, for the first time, revealed to an international conference of enrichment experts. Scientific and technical features of the process are described. It is an aerodynamic type process using a high performance stationary-walled centrifuge using UF_6 in hydrogen as a process fluid. Information is released on the progress of the pilot plant at Valindaba, overall economic parameters for a commercial plant based on the South African process, future plans and general matters of policy. (INIS)

14987 (K-1839(Pt.5)) BEHAVIOR OF THE MINOR URANIUM ISOTOPES IN SEPARATION CASCADES. Part V: Review and Appraisal. Blumkin, S.; Von Halle, E. (Oak Ridge Gaseous Diffusion Plant, Tenn. (USA)). 19 Jan 1976. Contract W-7405-eng-26. 35p. Dep. NTIS $5.00.

Part V is the final chapter of the completion report for this study. The results of the calculations made to determine the behavior of the minor uranium isotopes (^{234}U and ^{236}U) in separation cascades and the results of the two plant tests made to substantiate the validity of the calculations are reviewed briefly. Based on the fact that the ^{234}U and ^{236}U concentrations relative to that of ^{235}U in cascade withdrawal streams reflect the cascade flowsheet, it was concluded that the use of the minor isotope concentration measurements in cascade withdrawal streams, which is usually referred to by the acronym, MIST, is a potentially valuable adjunct to material accounting for safeguarding a ^{235}U enrichment cascade. A characteristic of MIST which qualifies it particularly for safeguards application under the NPT is the fact that its use is entirely non-intrusive with regard to process technology and proprietary information. The usefulness of MIST and how it may be applied are discussed briefly. To conclude this appraisal of MIST an enumeration is made of the capabilities that a safeguards inspection team would have to possess in order to apply MIST. (auth)

14988 (KFK-2235) URANIUM ENRICHMENT BY THE SEPARATION NOZZLE PROCESS. Becker, E. W.; Bier, W.; Ehrfeld, W.; Schubert, K.; Schuette, R.; Seidel, D. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Kernverfahrenstechnik). Nov 1975. 24p. (CONF-751101-66). Dep. NTIS (US Sales Only) $3.50.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum; San Francisco, California, USA (16 Nov 1975).

The separation nozzle process for the enrichment of the light uranium isotope ^{235}U was developed at the Karlsruhe Nuclear Research Center as an alternative to the gaseous diffusion and centrifuge processes. Since 1970 the STEAG company, Essen, has been involved in the commercial implementation of the nozzle process. A first separation nozzle demonstration plant with a separative capacity of 180 t SWU/a will be erected in Brazil with the participation of the Brazilian company NUCLEBRAS and the German companies STEAG and INTERATOM. Methods for the mass production of separation elements were developed by industry and extensive performance tests were carried out on commercially fabricated separation elements. Two prototype separative stages were successfully tested in Karlsruhe. Besides further plant components, a prototype of a UF_6 recycle facility was developed which serves the purpose of stripping the UF_6 from the light auxiliary gas to be recycled in a separation nozzle cascade. The performance level achieved to date characterizes the separation nozzle process as reliable and feasible economically. Therefore, the erection of a separation nozzle demonstration plant can be recognized as the implementation of an enrichment process that combines a reliable and comparatively simple technology with a high potential for further improvements. (auth)

14989 (UCRL-Trans-10965) PROCEDURE AND DEVICE FOR SEPARATING PARTICLES SUCH AS THE ^{235}U ISOTOPE OF URANIUM FROM A PLASMA. Janes, G. S. 1973. Translation of Belgian Patent No. 807,116. 20p. Dep. NTIS $3.50.

A process and a device for separating the particles of a plasma and, in particular, for collecting selectively ionized isotopes for isotope enrichment are described. A new technique for efficient enrichment of ^{235}U involves exposing uranium vapor to a pulsating laser beam, producing a plasma of selectively ionized ^{235}U atoms, thus permitting the separation of ^{235}U ions according to their electric charge. (LK)

14990 METHOD AND APPARATUS FOR SEPARATING GAS MIXTURE BY CENTRIFUGING. Tamai, K.; Tsuno, H.; Hashimoto, O.; Iwai, T.; Shionoya, K. (to Doryokuro Kakunenryo Kaihatsu Jigyodan). US Patent 3,915,673. 28 Oct 1975. Priority date 10 Apr 1969, Japan. 14p.

A process and a centrifuge are provided for separating a gas mixture having different molecular weights into a light fraction and a heavy fraction. The process comprises the steps of introducing the gas mixture into at least one intermediate space formed between at least two concentric rotors, and separating the gas mixture into a light fraction and a heavy fraction by subjecting the gas mixture to centrifugal forces by rotation of the concentric rotors. The centrifuge comprises at least two concentric rotors rotatably in a housing and defining between them one or more intermediate spaces, means for driving the rotors, and means for introducing the gas mixture into each intermediate space, whereby in operation the mixture is subjected to centrifugal forces. (auth)

14991 URANIUM ENRICHMENT IN THE NETHERLANDS. Atoomenerg. Haar Toepass.; 17: No. 10,217(Oct 1975).

The operation of a pilot-plant constructed in Almelo in The Netherlands for uranium enrichment is described. This plant was built as a result of an agreement between the governments of the Netherlands, F. R. Germany and the UK on collaboration

in the development and exploitation of the gas centrifuge process for producing enriched uranium. (NL)

14992 SEPARATION OF URANIUM ISOTOPES USING LASER BEAMS. Rigny, P.; Bir, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Genie Isotopique). Bull. Inf. Sci. Tech. (Paris); No. 204, 61-69(Jun 1975). (In French)

Laser isotope separation of uranium is considered on a non-classified basis and several possible physical schemes involving molecular compounds or atomic vapor are presented. A discussion on the requirements of the lasers to be used is attempted. (FR)

14993 PROSPECTS OF DYE LASER APPLICATIONS TO THE SELECTIVE LASER PHOTOPHYSICS. Letokhov, V. (Inst. of Spectroscopy, Moscow). Spectrosc. Lett.; 8: No. 9, 697-709(1975).

Applications of tunable dye lasers in the process of selective atomic ionization have been considered for the purpose of laser isotope separation and substance purification. (auth)

14994 DEVELOPMENT TENDENCIES IN THE ENERGY TECHNIQUE IN 1975. Dietzel, F. Energie; 27: No. 7, 200-203(Jul 1975). (In German)

From energy engineering convention 1975; Duesseldorf, F. R. Germany (5 May 1975). 2 figs.; 1 tab.

This is a survey on the lecture series under the heading "Energy Sources," held on the occasion of the "Energietechnische Tagung" from the May 5-7, 1975, in Duesseldorf (FRG). The following points are dealt with: (a) energy not exploited, (b) the energy supply until 1980, (c) a long-term energy prognosis, (d) unusual energy sources: the present situation and the chances of their use, (e) possibilities and limits of worldwide oil supply, (f) Western Europe's supply with natural gas, (g) methods of enrichment of nuclear fuels. Dealt with only casually are: energy conversion and storage, energy transport, energy utilization, and the effects of energy. (DE)

14995 LASER ISOTOPE SEPARATION USING AN INTRACAVITY ABSORPTION TECHNIQUE. Datta, S.; Anderson, R.W.; Zare, R.N. (Department of Chemistry, Columbia University, New York, New York 10027). J. Chem. Phys. 63: No. 12, 5503-5505 (15 Dec 1975).

Selective absorption of $I^{37}Cl$ by a broad band dye laser is obtained by placing a cell containing $I^{35}Cl$ in the cavity of the laser in order to create "holes" at the absorption frequencies of $I^{35}Cl$ in the laser output. It is shown that this method can be used to obtain highly efficient photochemical isotope separation. (AIP)

Isotopic Power Sources

Refer also to abstract 16123.

14996 MONITORING THERMOELECTRIC PROPERTIES OF NONINSTRUMENTED RTG'S. Bennett, A. (McDonnell Douglas Corp., Richland, WA). Energy Convers.; 15: No. 1/2, 39-43 (1975).

A technique is described for accurately monitoring the bulk physical properties of a thermopile encased in a RTG. The method makes use of the two I-V (current-voltage) curves common to thermoelectric thermopiles. One is the steady state or thermal equilibrium I-V curve and the other is the dynamic or non-equilibrium I-V curve. The intersection of the dynamic curve with the equilibrium curve provides the data for calculating the Seebeck coefficient and thermopile resistance. The thermal conductance is obtained from data taken at open circuit conditons. Mathematical models, experimentally supported, are provided. (auth)

14997 OPTIMIZED SNAP III POWER GENERATOR DESIGN FOR SPACECRAFT. Greefield, H. New York; American Rocket Society ([nd]). 18p.

From American Rocket Society space power systems conference; Santa Monica, CA, USA (1960).

Design performance studies on the original SNAP III type of thermoelectric generator were made to optimize its use as a power system for special spacecraft missions. (auth)

Radiation Sources

Refer also to abstracts 14354 and 14914.

14998 (AEC-tr-7315, pp 22-27) CALCULATION OF THE TEMPERATURE FIELDS OF EXTENDED IRRADIATORS. Stepanov, G. D.; Osipov, V. B. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

The production of powerful radiation equipment is related to the forming of extended irradiators of different geometry with considerable total and specific activities. This leads to the release of a higher amount of heat in the irradiator's zone. This is due to the absorption of radiation by the sources and constructional materials, which may cause unacceptable heading up of the standard radiation sources and undesirable thermal deformation of the irradiator. Thus, it is necessary to determine the temperature fields of the irradiators, and to provide the necessary conditions for their normal functioning. (auth)

14999 (AEC-tr-7315, pp 28-34) FORMING OF THE DOSE FIELD OF A SPIRAL TYPE IRRADIATOR. Terent'ev, B. M.; Dubnova, S. K.; Kupriyanova, I. A. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

An irradiator of the linear type was used in the earlier equipment for radiation for the realization of low-energy radiation-chemical processes in the aqueous phase. However, this irradiator cannot always provide the necessary medium dose rate in the given volume, e.g., in equipment of high capacity, i.e., with a high reaction volume. In this case it is suitable to use, instead of the linear irradiator, an irradiator in which the radioactivity is distributed along a spiral. A method for calculating the dose field for such an irradiator is presented. (auth)

15000 (AEC-tr-7315, pp 37-40) CALCULATION OF SYSTEMS WITH A PLANE IRRADIATOR AND BLOCK OBJECTS OF A SMALL DENSITY. Vikulin, A. A.; Terent'ev, B. M.; Sivitsku, V. S. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

Irradiation of block objects characterized by small density values is frequently encountered in some radiation processes (radiation for sterilization), e.g., irradiation of diverse medical articles whose density rho less than or equal to 0.3 gm/cm^3. It is important to clarify, whether it is necessary to consider multiple scattering in the calculation of the dose rate field in the irradiated object with the indicated density values. This problem was decided for several values of (rho) for a tissue-equivalent block, and for air where multiple scattering is practically absent, i.e., the accumulation factor is equal to 1. (auth)

15001 (AEC-tr-7315, pp 40-48) CHOICE OF A RADIATION SOURCE ACTIVITY AND CALCULATION OF DOSE FIELDS FOR IN-CAVITY IRRADIATION ON A HOSE APPARATUS. Episyutin, G. P.; Rimman, A. F.; Zhokovsku, E. A.; Kheteev, M. V.; Sul'kin, A. G.; Komar, V. Ya. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

The main problem in the working out of a hose gamma-therapeutic apparatus for in-cavity irradiation, is the creation of a dose field promoting maximum destruction of the carcinogenic cells and minimum radiation load on the healthy tissues. Since the possibility of placing radiation sources and production of complex three-dimensional irradiators is determined by the dimensions and form of the cavities, certain limits are put on the geometrical parameters of the irradiators. The irradiator, having the most frequently used form in radiogynaecology, is formed from a combination of a linear source for the uterine canal (tube) and two linear or point sources placed in the canopies of the vagina. Such a system for placing the sources in in-cavity irradiation together with remote irradiation is sufficiently effective for the majority of the gynaecological localizations. Therefore, it is necessary in the first place to have the possibility of evaluating dose fields created by different combinations of sources of radiation positioned according to this system. It is also necessary to substantiate the choice of the radioactive isotope, and the activity of the diverse sources included in the irradiator (combination). A scheme for accomplishing these objectives is presented. (auth)

15002 (AEC-tr-7315, pp 226-235) LOGICAL-STRUCTURAL MODEL OF THE FORECASTING OF DEVELOPMENT OF RADIATION TECHNOLOGY. Panov, V. Yu.; Kodyukov, V. M.; Kopytova, M. K.; Sokolova, Z. I. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

The suggested model for forecasting of the development of radiation technology is composed of systems of independent forecasts which have the following items: (1) the level of radiation technology and the perspectives of its development; (2) the supply articles and materials that are used or can be used, and the perspectives of their development; (3) the perspectiveness

of the application of radiation technology in national economy; and (4) the need for industrial resources that guarantee the productive capacity of radiation technology. (TFD)

15003 (FRNC-TH-564) STUDY OF COLLIMATION OF A FAST NEUTRON BEAM FOR NEUTRON THERAPY. Marcie, S. (Toulouse-3 Univ., 31 (France)). 1975. 89p. (In French). INIS.

The realization of a collimator equivalent to the collimators of high energy radiotherapy was studied. An electrostatic accelerator SAMES was used as generator of fast neutrons using the DT reaction. The objective to reach requires the precise knowledge of the beam characteristics in air and tissue-equivalent medium: fast neutron isofluence, gamma contamination of the neutron beam, activation of materials and total absorbed dose. The radiation detectors used are: activation detectors for the neutron fluence measurement, thermoluminescent detectors for γ detection and an ionization chamber for the total absorbed dose measurement. The choice of the collimator is guided by the required performances by the medical worker. Three models of collimators, with protection, were built. The results are given for the beam in the air and in a tissue-equivalent medium. (FR)

15004 UMSCHLOSSENE RADIOAKTIVE STOFFE. Wiederholungspruefungen auf Dichtheit der Huelle. Entwurf. (Sealed Radioactive Sources. Leak Test Methods for Recurrent Inspections. Draft). Berlin, F.R. Germany; Beuth (May 1975). 5p. (In German). (DIN-25426(Bl.4)).

3 figs.

This draft standard gives specifications for leak tests on sealed radioactive sources during operation and storage (in-service inspections). This applies to inspections at regular intervals imposed by order of the licensing and control authority as well as to tests which have to be carried out by an official test authority upon request of the user immediately after excessive strain on the sealed radioactive source. The standard does not apply to leak tests with sealed radioactive sources containing a free or adsorbed radioactive gas (e.g., krypton-85, tritium). Also excluded from the standard are sealed radioactive sources with activities above 100 Ci. (DE)

15005 KLASSIFIKATION VON INNERBETRIEBLICH VERWENDETEN ARBEITS- UND TRANSPORTBEHAELTERN, STRAHLENSCHUTZTISCHEN UND STRAHLENSCHUTZTRESOREN IN NUKLEARMEDIZINISCHEN BETRIEBEN. Entwurf. (Classification of Containers for Handling and Transporting of Radioactive Materials and for Radiation Protection Tables and Safes in Installations for Nuclear Medicine. Draft). Berlin, F. R. Germany; Beuth (Jun 1975). 5p. (In German). (DIN-6850)

3 tabs.

Aside from some definitions, the draft standard gives tables for the γ-sources most commonly used in nuclear medicine: (1) the wall thickness of the lead shield (0.5, 1, 2, 3, 5, and 10 cm) as a function of activity for a dose rate of 2.5 mR/h (179 pA/kg) at a distance of 25 cm from the center of the radioactive source; (2) the wall thickness of iron, baryta cement and normal cement in cm (as under 1) which are equivalent to a lead shielding of s cm; and (3) lead equivalents of lead crystal windows which can be used in lead shields of a thickness of s cm for a dose rate of 7.5 mR/h (537 pA/kg) in a distance of 25 cm from the radiation source. (DE)

15006 IMPORT AND EXPORT OF RADIOACTIVE MATERIALS 1974. Umwelt (Inf. Bundesminist. Innern); No. 42, 3-6(Jul 1975). (In German).

8 tabs.

A comparison of the imports of 1974 with the imports of 1973 shows a rise for nuclides and a fall for sealed radiation sources of more than 50 Ci as well as for nuclear fuels and materials. The export balance as compared to 1973 showed an increase for nuclides and for sealed radiation sources of more than 50 Ci while the export rate of nuclear fuels and materials dropped. (DE)

Design and Fabrication

Refer also to abstract 14613.

15007 (AEC-tr-7315, pp 108-115) SOME FEATURES OF A PULSE PROTON GENERATOR. Kir'yanov, G. I.; Dadanov, A. M.; Dereza, K. K. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

A proton source for use in activation analysis is described. A beam of deuterium ions, generated in an ion source and accelerated by an acceleration tube, bombard a target saturated with ^{3}He. Protons are formed through the reaction ^{3}He(d,p)^{4}He and their energy is 15 MeV. (TFD)

15008 (AEC-tr-7315, pp 148-154) EXPERIMENTAL HOSE gamma-THERAPEUTIC APPARATUS FOR IN-CAVITY IRRADIATION. Rimman, A. F.; Sul'kin, A. G.; Komar, V. Ya.; Zhukovsku, E. A. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

The use of high dose rates of gamma-radiation, in the in-cavity radiation therapy, offer a number of advantages over the methods applied at present for irradiation with the use of sources of relatively low activity. However, the wide introduction of this method is hindered by the uncertainty of some factors of biological and clinical character, by the absence of exact data about the dose distribution in the direct vicinity of radiation sources and the respective equipment. The experimental model of the dose gamma-therapeutic apparatus for in-cavity irradiation, worked out by VNIIRT is described. (TFD)

15009 (AEC-tr-7315, pp 154-162) THEORETICAL BASIS OF THE DESIGN OF SINGLE-SPIRAL SPRING COUNTERBALANCES OF RADIATION EQUIPMENT. Sul'kin, A. G. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

The spring counterbalances with a single-spiral compensator, applied in radiation equipment, are subdivided into two modifications [1]. The first modification has the spiral part connected by a flexible element to the balancing weight, and the cylindrical part is connected to the balancing spring (the arm of the balancing force is fixed), While for the second modification, the spiral part of the compensator is connected to the spring and the cylindrical part is connected to the load (the arm of the balanced constant force is fixed), The connection of the balancing spring with the compensator is realized either directly through the flexible element (cable, chain), or by the means of a movable block that permits to increase the hardness of the spring at the same energy capacity and consequently to decrease its overall dimensions. Equations for calculating the profile of the spiral are presented. (auth)

15010 (AEC-tr-7315, pp 186-192) ADDITIONAL HERMETIC SEALING OF THE beta-RADIATION SOURCE BIS-M. Nikolaev, A. A.; Chubkov, V. N. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

The aim of the present work is the widening of the limits of efficiency of the ampoule of the ^{90}Sr source BIS-M (MRTU-10-64-65), for its application in articles operating under the following conditions: temperature of the surrounding medium changes from -60 yields $+50^0$C; relative humidity up to 98 percent; thermal collision at a temperature of 300^0C during 2 min.; acceleration 0,1 to 10 g; vibration 1 to 25, 25 to 200, 200 to 600, and 600 to 2000 hertz with accelerations up to 1, 6, 8, and 12 g respectively; pressure of the medium 1 to 6 gauge atmosphere; corrosive medium. (auth)

15011 (INIS-mf-1707) CALIBRATION SOURCES FOR RADIOACTIVE CONTAMINATION MONITORS. Leuschner, A. H.; Kruger, J.; Vande Putte, D. W. (Atomic Energy Board, Pelindaba, Pretoria (South Africa). Physics Div.). [nd]. 5p. (In Afrikaans). INIS.

Sources for routine checking and for calibration of contamination monitors at the Atomic Energy Board have been manufactured from standard solutions of ^{36}Cl and ^{239}Pu. Data on these sources are given. (INIS)

15012 BILDZEICHEN. Roentgenroehre. (Graphical Symbols. X-ray Tube). Berlin, F.R. Germany; Beuth (Aug 1972). 1p. (In German). (DIN-30600(Bl.76)).

1 fig.

X-ray tube of a nominal size of 20 mm is described. (DE)

15013 BILDZEICHEN. Roentgenstrahler Allgemein. (Graphical Symbols. X-Ray Tube Assembly). Berlin, F. R. Germany; Beuth (Aug 1972). 1p. (In German). (DIN-30600 (Bl.68)).

1 fig.

X-ray tube assembly of a nominal size of 12 mm is described. (DE)

15014 AEROSOL GENERATOR FOR PRODUCTION OF RADIOACTIVE AEROSOLS BY EVAPORATING URANIUM DIOXIDE. Pusch, W. M. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Vienna. Forschungszentrum). Atomkernenergie; 26: No. 2, 122-124(1975). (In German).

5 figs.

An experiment is being done to study the behavior of radioactive aerosols in the organism of miniature swines after inhalation. The aerosol generator used for the inhalation experiments is described. The main part of the generator is a gas burner for evaporating irradiated UO_2-pellets. (DE)

Industrial Uses

15015 (AEC-tr-7315, pp 170-177) STERILIZATION OF MEDICAL ARTICLES FROM POLYMERIC MATERIALS BY A LINEAR ELECTRON ACCELERATOR. Vanyushkin, B. M.; Kon'kov, N. G.; Korzhenevsku, Z. S.; Krylov, S. Yu.; Povalikhin, N. S. 1971. Translated from Radiats. Tekh.; No. 6, (1971). In Radiation Technology, Issue 6.

The design and operating parameters of the industrial assembly are described. (TFD)

15016 (INIS-mf-1768, pp 1-76) RATIONALIZATION OF MINING, TRANSPORTATION, AND MANAGEMENT CONTROL OF RAW MATERIALS IN MINING INDUSTRY. Oct 1973. (In Czech)

In effective application of radioisotopes and of ionizing radiation in mining. I.

Research on the application of radioisotopes in mining with the object of improving the productivity of labor and the economy of production is reviewed. The application of sealed sources is considered with respect to rationalization of mining, transport, and routine inspection of raw materials in the mining industry. A critical evaluation is presented of scientific and research works and of operating experience both in Czechoslovakia and elsewhere. The current state of sealed sources applications in Czechoslovakia and in other countries is evaluated. (INIS)

15017 (JAERI-M-6000) CONCEPTUAL DESIGN OF A COMMERCIAL POTATO IRRADIATOR FOR INSTALLATION IN SHIHORO, HOKKAIDO. Sato, T. (Japan Atomic Energy Research Inst., Takasaki, Gunma. Takasaki Radiation Chemistry Research Establishment). Mar 1975. 42p. (In Japanese). Dep. NTIS (US Sales Only) $5.00.

With permission of the Government for γ-irradiation of potatoes for sprout inhibition in August 1972, it was decided to construct a commercial potato irradiator in Shihoro, Hokkaido. Design study of the irradiator has been carried out by the Takasaki Research Establishment, JAERI, upon request of Shihoro Agricultural Co-operative Association which will own the irradiator. Concerning the irradiation conditions and the dose distribution in a potato container, the following were revealed: for the large container holding 1.5 tons of potatoes with irradiation by a circular-line conveyor moving around the ^{60}Co source, 300 kCi of ^{60}Co at least is necessary for attaining the absorbed-dose range of 6 to 15 krad and the irradiation capacity of 10,000 tons per month. If a straight-line motion conveyor is used instead, larger intensity of the ^{60}Co source is required to attain the same irradiation conditions. The source may preferably be stored in a water-filled pool rather than a lead- or concrete-shielded dry container. (auth)

15018 MEASURING OF THE TEMPERATURE MAXIMA AND DISTRIBUTION ON THE SURFACE OF DYNAMICALLY HEATED MOVING SYSTEMS, USING ^{85}Kr TECHNIQUES. Fodor, J.; Leb, L.; Muk, G. (Research Inst. of Automotive Industry, Budapest). pp 422-427 of Temperature Measurement, 1975. Billing, B. F. (ed.). London; Institute of Physics (1975).

From conference on temperature measurement; Teddington, UK (9 Apr 1975). See CONF-750490-.

The degassing properties of noble gas metal systems are suitable for measuring the temperature maxima and in a ^{85}Kr metal system it is easy to measure the degassing process, for example by following up the change in radioactivity. The method was used for measuring the temperature distribution of thermal loading in the combustion chamber of diesel engines and supercharged diesel engines. (auth)

LIFE SCIENCES

Radiation Effects on Biochemicals

15019 (COO-690-47) EFFECT OF RADIATION ON PROTEINS AND RADIATION EFFECTS IN BIOCHEMISTRY AND ORGANIC CHEMISTRY. Final Report, October 15, 1957–October 14, 1974. Tolbert, B. M. (Colorado Univ., Boulder (USA)). 1974. Contract E(11-1)-690. 126p. Dep. NTIS $5.50.

A summary is made of a fifteen year study of chemical effects of radiation of amino acids and proteins. Included is a list of publications: 54 papers, reports and abstracts, and 10 M.S. and Ph.D theses. The report concludes with details of the final two studies done under this contract. These are, first, a study of post-irradiation effects of various gases on gamma irradiated lysozyme. This study showed that H_2S, O_2, NO, and N_2O treatment changed the amount of aggregation products, and also that a certain amount of the irradiated lysozyme was subject to main chain cleavage. The second was a study of proteins in rabbit eye lens cataracts induced by x-irradiation or a high galactose diet. The cataract proteins were more soluble in water than normal proteins, and were present in lower amounts in the eye lens. (auth)

15020 RADIATION CHEMICAL STUDIES OF THE SENSITIZER DIAMIDE. Whillans, D. W.; Neta, P. (Mount Vernon Hospital, Northwood, Eng.). Radiat. Res.; 64: No. 3, 416-430 (Dec 1975).

A detailed study of the radiation chemistry of the radiosensitizer Diamide (diazenedicarboxylic acid bis-dimethylamide) using ^{60}Co irradiation, pulse radiolysis, pulse conductivity, and ESR techniques is presented. Reduction of Diamide by e/sub aq/⁻ (k equals 2.8×10^{10} M^{-1} sec^{-1}) is followed by rapid protonation of the radical anion by H^+ at a diffusion-controlled rate, or by $H_2PO_4^-$ at a rate of 7×10^7 M^{-1} sec^{-1}. The protonation is confirmed by pulse conductivity experiments and supported by ESR observation of the dicarboxyhydrazyl radical. The radical anion is also formed by electron transfer from thymine·⁻ (k equals 5.0×10^9 M^{-1} sec^{-1}), from PNAP·⁻ (k equals 1.6×10^7 M^{-1} sec^{-1}), and from $(CH_3)_2COH$ and CO_2^- (k approximately equal to 2.5×10^9 M^{-1} sec^{-1}). The protonated radical reacts with oxygen at a rate of about 10^8 M^{-1} sec^{-1}, but not by electron transfer. The protonated radical decays by a second-order reaction (2k equals 4×10^8 M^{-1} sec^{-1}) with G(-Diamide) equals 3.1 in the formate system, suggesting a disproportionation reaction. ^{60}Co irradiation of N_2O saturated solutions of Diamide leads to a shift in lambda /sub max/ and an increase in absorption before subsequent destruction. Optical studies using pulse radiolysis show a three-fold increase in transient absorption at 400 nm between pH 6 and 9, and the relative spectra at these pH's are dissimilar, suggesting the presence of a radical with pK approximately equal to 7.5. Pulse conductivity experiments show that about 50 percent of the radicals are dissociated at pH 9.8. It is suggested that OH radicals react by both addition to the N double bonds N bond and abstraction from the methyl groups at approximately equal rates and that the OH adduct dissociates with pK approximately equal to 7.5. The rate of signal formation at 400 nm is also pH dependent. A rate constant of 7×10^9 M^{-1} sec^{-1} was observed at pH 2, 2.3, 2.8, 4, 4.8, 6.5, and 6.8 and a lower value is measured at higher pH. Indirect measurement of the rate of OH attack by phenylalanine competition gives a value of 4.2×10^9 M^{-1} sec^{-1} independent of pH from 4 to 8. (auth)

15021 RADIATION PROTECTION OF HYALURONIC ACID IN THE SOLID STATE. Armand, G.; Baugh, P. J.; Balazs, E. A.; Phillips, G. O. (Boston Biomedical Research Inst.). Radiat. Res.; 64: No. 3, 573-580 (Dec 1975).

The effects of gamma irradiation on hyaluronic acid (HA) and its molecular complex with cetyl pyridinium cations have been examined in the solid state. On the basis of the nature of the electron spin resonance (ESR) spectra, radical yields, and physical chemical data, there is good evidence that protection of hyaluronic acid occurs when irradiated in a complex with cetyl pyridinium cations. The radiation protection conferred on the polyanion by the cetyl pyridinium cations is discussed in terms of energy transfer processes. (auth)

15022 EFFECTS OF GAMMA RADIATION ON SOLUTIONS OF ACETYLCHOLINESTERASE. Nayar, G. N. A.; Srinivasan, S. (Banarus Hindu Univ.). Radiat. Res.; 64: No. 3, 657-661 (Dec 1975).

Dilute solutions of bovine erythrocyte acetylcholinesterase were irradiated by 30, 60, 90, and 120 krad of ^{60}Co gamma rays under air at around 5°C. The enzyme activity decreased progressively with radiation dose. Ultraviolet spectra measurements indicated conformational changes in the enzyme with radiation dose. Part of the decrease in the activity of the enzyme after irradiation by 120 krad could be accounted for by the splitting of the enzyme into two pieces of molecular weights 73,000 and 7500. (auth)

15023 REACTIONS OF HYDROGEN ATOMS IN AQUEOUS SOLUTIONS: EFFECT OF pH ON REACTIONS WITH CYSTEINE AND PENICILLAMINE. Wu, J. T.; Kuntz, R. R. (Univ. of Missouri, Columbia). Radiat. Res.; 64: No. 3, 662-666 (Dec 1975).

The total rate constant for H-atom reactions with cysteine and penicillamine has been determined at pH 1 and pH 6 utilizing a photolytic source of H-atoms. The effect of COOH dissociation is to increase k/sub cysteine/ by 1.3 and k/sub penicillamine/ by 1.75. This effect is of the same magnitude as that observed for nonsulfhydryl amino acids. At higher pH values, dissociation of NH_3^+ causes further enhancement of the rate for penicillamine. The mechanism of H-atom reactions with these amino acids appears to be independent of pH in the range of 1 to 6. (auth)

15024 FORMYL RADICALS IN X-IRRADIATED FROZEN AQUEOUS SOLUTIONS OF DNA AND NUCLEIC ACIDS CONSTITUENTS. Cannistrato, S.; Lion, Y.; Van De Vorst, A. (Univ., Liege). Radiat. Res.; 64: No. 3, 581-592 (Dec 1975).

Frozen aqueous solutions of DNA and nucleic acids constituents have been x-irradiated at 77°K and observed by electron spin resonance. In nearly all the sugar-containing compounds the characteristic doublet due to formyl radicals is observed along with other spectral components. It was concluded that HCO radicals arise from pentose ring breakage, which may occur even at 77°K. According to the proposed scheme, the free radicals would be induced either by direct or indirect effects. (auth)

15025 PULSE RADIOLYSIS STUDIES OF ELECTRON TRANSFER REACTION IN MOLECULES OF BIOLOGICAL INTEREST. I. The Reduction of a Disulfide Bridge by Peptide Radicals. Faraggi, M. (Nuclear Research Center, Beersheba, Israel); Redpath, J. L.; Tal, Y. Radiat. Res.; 64: No. 3, 452-466 (Dec 1975).

The reduction of the disulfide bridge in the lipoate anion by peptide radicals and the formate radical ion (CO_2^-) has been studied using the pulse radiolysis method. Peptide radicals were produced by the reaction of the hydrated electrons with the peptide. It was found that e^-/sub aq/ reacts with diglycine, chloro-acetyl glycine and chloroacetyl diglycine to form a deaminated peptide radical ($\cdot CH_2CONHCH_2COR$). The reaction of e^-/aq/ with triglycine at neutral pH forms two radicals: (a) the deaminated radical which is formed when the e^-/sub aq/ reacts with the carbonyl group in an alpha position to the amino group, and (b) an "electron adduct" on the carbonyl group of the peptide bond which is formed when the e^-/sub aq/ peptide reaction occurs at other positions. The "electron adduct" on the carbonyl radical can be formed by the reaction of the e^-/sub aq/ with acetyl amide. The rate constant for reduction of the lipoate ion disulfide bridge by the deaminated radical was evaluated to be 5×10^8 M^{-1} sec^{-1}, while that for "electron adduct" radical and the formate radical is approximately 5×10^9 M^{-1} sec^{-1}. In view of these results a multi-step mechanism is suggested for the e^-/sub aq/ reduction of S–S bridge proteins. CO_2^- reacts directly with the disulfide bridge. (auth)

15026 APPLICATION OF RAPID LYSIS TECHNIQUES IN RADIOBIOLOGY. I. The Effect of Oxygen and Radiosensitizers on DNA Strand Break Production and Repair in E. Coli B/r. Sapora, O.; Fielden, E. M.; Loverock, P. S. (Inst. of Cancer Research, Sutton, Eng.). Radiat. Res.; 64: No. 3, 431-442 (Dec 1975).

The number of single-strand breaks per single-strand genome produced by irradiating E. coli B/r in suspension has been measured as a function of elapsed time between irradiation and lysis. Between 0.2 and 2 sec after irradiation, the number of breaks in O_2 and N_2 remains constant at 32 and 9, respectively, following a 32 krad dose delivered in 12 msec. These values are the same at all temperatures between 0°C and 37°C. After 2 sec both excision and strand rejoining processes are observed with temperature-dependent rates. The oxygen enhancement ratio for ssb measured 300 sec after irradiation is 5.2 compared with 3.6 at 0.2 sec and 3.0 for cell survival. The radiosensitizer PNAP mimics oxygen in producing single-strand breaks, whereas NPPN does not affect the number of breaks observed in N_2 but it does inhibit repair. (auth)

15027 SENSITIVITY OF RIBOSOMAL FUNCTIONS IN TETRAHYMENA PYRIFORMIS TO VARYING DOSES AND DOSE RATES OF GAMMA-RADIATION. Oleinick, N. L.; Rustad, R. C. (Case Western Reserve Univ., Cleveland). Radiat. Res.; 64: No. 3, 509-517 (Dec 1975).

Polysome content and rate of amino-acid incorporation have been measured in exponentially growing cultures of the ciliate protozoan Tetrahymena pyriformis after doses of 0 to 120 krad of ^{60}Co gamma radiation delivered at three different dose rates. The polysome content decreases exponentially with increasing dose at all three dose rates. Curiously enough, the sensitivity to dissociation was lower at the intermediate dose rate than at either the high or low one. Simple target theory analysis of the data indicates a target size for polysome dissociation in the range between a single ribosome and a disome. Amino-acid incorporation is more sensitive to radiation than is polysome content. Data obtained at the highest dose rate suggest that there is a second sensitive target which is considerably smaller than the more sensitive one. (auth)

15028 RADIATION CHEMISTRY OF CARBOHYDRATES. Pt. 6. γ-Radiolysis of Glucose in Deoxygenated N_2O Saturated Aqueous Solution. Dizdaroglu, M.; Henneberg, D.; Schomburg, G.; von Sonntag, C. (Max-Planck-Institut fuer Kohlenforschung, Muelheim an der Ruhr (F. R. Germany). Abt. fuer Strahlenchemie). Z. Naturforsch., B; 30: No. 3, 416-425(1975).

6 figs.; 3 tabs.; 44 refs.

In the γ-radiolysis of deoxygenated N_2O-saturated aqueous solutions of D-glucose (10^{-2} M, $1 \times 10^{19} - 4 \times 10^{19}$ eV/g, dose rate 4.3×10^{18} eV/g × h at 25°C), several products have been identified. G-values were also determined. In the primary processes OH radicals and H atoms from the radiolysis of the solvent water abstract carbon bound hydrogen atoms from D-glucose to give all six possible primary glucosyl radicals. The observed products are formed in disproportionation reactions of the primary glucosyl radicals or of sugar radicals which originate from the primary glucosyl radicals by water elimination rearrangements, or loss of carbon monoxide. (DE)

15029 RADIATION-SENSITIVE PYRIMIDINE AUXOTROPHS OF USTILAGO MAYDIS. II. A Study of Repair Mechanisms and uv Recovery in Pyr I. Moore, P. D. (National Inst. for Medical Research, London). Mutat. Res.; 28: No. 3, 367-380 (Jun 1975).

Two mutants at the pyr I locus have been used to study the radiation sensitivity of pyrimidine auxotrophs of Ustilago maydis. The mutant pyr I-1 has a reduced level of thymidine nucleotides, and this is a likely basis of the sensitivity. This strain is able to excise pyrimidine dimers from its DNA and is cross-sensitive to γ rays and nitrosoguanidine as well as to uv. A diploid heteroallelic at the pyr I locus was uv-sensitive but not deficient in uv-induced mitotic recombination. The results suggest that the uv sensitivity may be due to the failure of a repair DNA polymerase to fill post-excision single-strand gaps in the DNA. The mutant pyr I-1 exhibits the property of uv recovery and this is shown to be dependent on the presence of dimers in the DNA. A mechanism for uv recovery is proposed in which a repair system, possibly involving recombination, is induced by the uv irradiation. (NL)

Radiation Effects on Cells

15030 (TID-26975, pp vp, Paper 2) RADIATION STUDIES: RADIATION MECHANISMS IN MAMMALIAN SYSTEMS. Laughlin, J. S.; Zeitz, L.; Djordjevic, B. 1975.

In biological effects of radiation and related biochemical and physical studies, November 1, 1974-September 30, 1975. (Sloan-Kettering Inst. for Cancer Research, New York (USA)).

Progress is reported on studies related to the effectiveness of fast neutrons for radiotherapy of solid tumors. Results are reported from studies on the survival of cultured mammalian cells (W 138, HeLa, and mouse melanoma cells) irradiated under oxic and anoxic conditions with or without BUdR treatment. The results are compared with the effects of x or gamma irradiation. (CH)

15031 X-RAY-INDUCED INHIBITION OF DNA SYNTHESIS IN CHINESE HAMSTER OVARY, HUMAN HeLa AND MOUSE L CELLS. Painter, R. B.; Young, B. R. (Univ. of California, San Francisco). Radiat. Res.; 64: No. 3, 648-656(Dec 1975).

An X-ray dose of 500 rad inhibits DNA synthesis in Chinese hamster ovary (CHO) cells, in HeLa S3 cells, and in mouse L cells. In no case can the inhibition we observed be explained on the basis of a pool effect or any other process that causes deficient use of exogenously supplied DNA precursors. In all cases the inhibition is mediated by a decrease in replicon initiation processes. Since this inhibition is observed at doses too low to affect individual replicons, we hypothesize that a single hit within a cluster of replicons in some manner blocks the initiation of all replicons within the cluster. (auth)

15032 EFFECT OF HEAT AND RADIATION ON SYNCHRONOUS CHINESE HAMSTER CELLS: KILLING AND REPAIR. Gerweck, L. E.; Gillette, E. L.; Dewey, W. C. (Colorado State Univ., Fort Collins). Radiat. Res.; 64: No. 3, 611-623(Dec 1975).

Synchronous Chinese hamster cells were heated to 45.5°C before, during, or after x irradiation. The lethal effects of heat and radiation treatment were determined by the capacity of single cells to form colonies. Heat treatment prior to irradiation during G_1 or S was more effective, in terms of cell killing than heat treatment during or after irradiation. The time interval between irradiation and subsequent heat treatment influenced survival. The half-time for maximal survival when heat followed irradiation was 20-30 min in both G_1 and S phase cells. Survival of cells which were heated, and then irradiated after heat treatment, indicated an independent, additive or synergistic interaction between heat and radiation, depending on the time of heat treatment and the phase of the cell cycle treated. Nine minutes of heat treatment during G_1 or 7 min during S decreased the shoulder region and increased the slope of the radiation survival curves. But most important, 7 min of heat prior to irradiation radiosensitized the relatively radioresistant S phase cells more than the relatively radiosensitive G_1 cells, and thus virtually eliminated the differences in radiosensitivity normally observed between G_1 and S. Repair of heat damage as determined by survival to subsequent irradiation, began approximately 6 hr after 9 min heat treatment during G_1, and approximately 12 hr after 7 min heat treatment during S. In both cases, heat damage was repaired in the absence of cell division; for heating in G_1, repair occurred during G_1, but for heating during S, repair may have been associated with movement into G_2. Cells exposed to split heat treatments during S repaired heat damage while they were still in S phase, and maximum survival was attained when 6 hr elapsed between the heat treatments. (auth)

15033 EFFECTS OF X-IRRADIATION ON CELL DIVISION, OXYGEN CONSUMPTION, AND GROWTH MEDIUM pH OF AN INSECT CELL LINE CULTURED IN VITRO. Koval, T. M.; Myser, W. C.; Hink, W. F. (Ohio State Univ., Columbus). Radiat. Res.; 64: No. 3, 524-532(Dec 1975).

Cultured Trichoplusia ni cells in exponential growth were administered x-ray doses of 10,000 R and then subcultured. The untreated cell population began exponential growth within a few hours after subculture, eventually reaching stationary growth phase 96 hr later at a cell density of 2.08×10^6 cells/ml, whereas the irradiated cell population did not change for 24 hr after irradiation and then began exponential growth at a rate similar to that of control cells, also reaching stationary phase at 96 hr, but at a cell density of 0.93×10^6 cells/ml, which is less than half the maximum density of controls. From 24 to 96 hr after treatment, the x-irradiated cells were characterized by an increased consumption of oxygen that was nearly twice the amount utilized by control cells. The pH of the cell growth medium increases over 96 hr from 6.3 to 6.6 for irradiated as well as for untreated cultures, but since the number of x-rayed cells is less than half the number of untreated cells, the pH increase, per cell, of medium from irradiated cultures is about twice that of medium from control cultures. (auth)

15034 RADIATION AND CHEMICALLY INDUCED POTENTIALLY LETHAL LESIONS IN NONCYCLING MAMMALIAN CELLS: RECOVERY ANALYSIS IN TERMS OF X-RAY- AND ULTRAVIOLET-LIKE-SYSTEMS. Hahn, G. M. (Stanford Univ., CA). Radiat. Res.; 64: No. 3, 533-545(Dec 1975).

Recovery from and fixation of potentially lethal damage after exposure of Chinese hamster cells to uv and to x irradiation were investigated, as was recovery after exposure to chemotherapeutic agents. Recovery after uv radiation has a T/sub $^1/_2$/ of about 20 hr; the fraction of cells able to undergo recovery depends upon nutritional factors both before and after exposure. After x irradiation, recovery proceeds with a T/sub $^1/_2$/ of approximately 2 hr and is much less influenced by nutritional factors. Fixation after serum stimulation has a T/sub $^1/_2$/ of 3 to 4 hr in uv-irradiated cells, a T/sub $^1/_2$/ of 30 min in x-irradiated cells. Recovery kinetics after nitrogen mustard and bleomycin exposures mimic those for x-ray exposure; after methyl methane sulfonate the kinetics are mainly uv-like, though with an x-ray-like component. Recovery by cells with BUdR-substituted DNA and irradiated with visible light is primarily x-ray-like, though with a uv-like component. There is no recovery by cells exposed to adriamycin or to 1,3-bis(2-chloroethyl)-1-nitrosourea. (auth)

15035 RADIOTOXICITY OF ^{125}I IN MAMMALIAN CELLS. I. Effects on the Survival Curve of Radioiodine Incorporated Into DNA. Bradley, E. W.; Chan, P. C.; Adelstein, S. J. (Harvard Medical School, Boston). Radiat. Res.; 64: No. 3, 555-563(Dec 1975).

The effect of iodine-125 incorporated into the DNA of asynchronous, exponentially growing LICH cells as IUdR has been examined with regard to cell survival. A maximum of 33 to 129 disintegrations per nucleus resulted in cell replication failure as determined

by clonal survival. Control experiments indicated that neither the chemical toxicity of the halogenated nucleoside nor the x rays due to iodine-125 in the extracellular medium played a role. Iodine-131-labeled IUdR was much less toxic and mimicked Na ^{131}I. The extreme toxicity of intranuclear iodine-125 appears to be due to the highly localized damage produced as a result of the Auger cascade. (auth)

15036 ENVIRONMENTAL FACTORS IN THE ORIGIN OF CANCER AND ESTIMATION OF THE POSSIBLE HAZARD TO MAN. Jones, H. B.; Grendon, A. (Univ. of California, Berkeley). Food Cosmet. Toxicol.; 13: No. 2, 251-268(Apr 1975).

The stages in the development of cancer are described as alteration of cellular function by the carcinogen; reinforcing interaction by proximal altered cells—a microscopic control force; failure of the restraining factors against tumorous proliferation within an organ—a macroscopic control; failure of restraining forces against tumorous growth in the body as a whole. All four stages are important in human cancers. Urethane-induced lung cancer is a single-stage process atypical of cancer induction except as an example of the first stage. The relationship of dose to time of appearance of cancers is shown to have general validity as a low relating latent time to the inverse cube-root of the dose. The law is explained as the consequence of the second carcinogenesis stage, in which there is interaction of cells altered by carcinogens. Several examples of the estimation of cancer risk are presented as they apply to current problems of exposure of man to low levels of diethylstilbestrol, nitrosamines and radiation. If the cube-root of the dose applies to the estimation of the time of appearance of cancers, low-dosage exposure at some levels is virtually without risk because the expected lifespan of those exposed is exceeded by the time necessary for low concentrations of altered cells to develop into cancers. (auth)

15037 REPORT OF BOARD IV: RADIATION DAMAGES AND RADIATION INDUCED DISEASES. Pauly, H. pp 209-218 of Progress Report of the Safety Commission of the Federal Ministry of the Interior for the Year 1973. Bonn, F. R. Germany; BMI (1973). (In German)

Board IV (radiation damage and radiation-induced diseases) worked on the effects of ionizing radiation on living organisms and studies the radiation damage it entailed. Investigations with cells or model systems serve to recognize certain causal relationships in an organism out of the diversity of reactions encountered. (DE)

15038 RESTORATION OF ULTRAVIOLET-INDUCED UNSCHEDULED DNA SYNTHESIS OF XERODERMA PIGMENTOSUM CELLS BY THE CONCOMITANT TREATMENT WITH BACTERIOPHAGE T4 ENDONUCLEASE V AND HVJ (SENDAI VIRUS). Tanaka, K. (Univ., Osaka); Sekiguchi, M.; Okada, Y. Proc. Natl. Acad. Sci. U. S. A.; 72: No. 10, 4071-4075(Oct 1975).

Ultraviolet (uv)-induced unscheduled DNA synthesis of xeroderma pigmentosum cells, belonging to complementation groups, A, B, C, D, and E, was restored to the normal level by concomitant treatment of the cells with T4 endonuclease V and uv-inactivated HVJ (Sendai virus). The present results suggest that T4 endonuclease molecules were inserted effectively into the cells by the interaction of HVJ with the cell membranes, the enzyme was functional on human chromosomal DNA which had been damaged by uv irradiation in the viable cells, all the studied groups of xeroderma pigmentosum (variant was not tested) were defective in the first step (incision) of excision repair. (auth)

Radiation Effects on Microorganisms

Refer also to abstracts 15026, 15029, and 15073.

15039 (AEC-tr-7315, pp 34-37) EVALUATION OF THE HETEROGENEITY OF THE ABSORBED DOSE IN BLOOD SAMPLING AND TRANSFUSION SYSTEMS DURING THEIR STERILISATION WITH ACCELERATED ELECTRONS. Vanyushkin, B. M.; Kon'kov, N. G.; Krylov, S. Yu.; Rumyantsev, S. A.; Tetekin, Yu. S. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

It is always required, in the irradiation of different products by accelerated electrons, that the distribution of the absorbed dose over the volume is within the specified limit. In the irradiation of block product, a way is chosen so that the input and output doses are almost equal. The situation becomes complicated when it is required to irradiate a highly heterogeneous product with electrons of an energy which does not exceed a certain value. Such products include all the possible medical articles, e.g., systems for sampling and transfusion of blood, ampoules, and injector tubings. These are widely sterilized by the radiation method. Regardless of the small average density, all these articles have thicknesses which are localized in separate directions, and which frequently exceed the value of the range of electrons. Methods are suggested for evaluation of the volume homogeneity of irradiation for blood sampling and transfusion systems. (auth)

15040 (AIAU-74502) USE OF HYDROTHERMALLY DEGRADED CELLULOSE WASTE MATERIAL AS CARBON SOURCE FOR MICROORGANISMS. Bobleter, O.; Niesner, R.; Roehr, M.; Stehlik, G.; Turanitz, K. (Atominstitut der Oesterreichischen Hochschulen, Vienna). 1974. 21p. INIS.

Report available from Atominstitut der Oesterreichischen Hochschulen A 1020 Vienna Austria, Schuettelstrasse 115.

An apparatus had been developed for the degradation of waste plant material (e.g. straw and paper) under hydrothermal conditions. By the use of C-14-labelled cellulose quantitative results of the degradation process were obtained. Candida utilis (weissenbachii) served as microorganism for growth experiments on the major breakdown compounds glucose, cellobiose, xylose, and arabinose. Radiation mutation experiments are being carried out to obtain strains which can withstand or use relative high furfural concentrations of the breakdown solution. (auth)

15041 (INIS-mf-1741) EFFECT OF DIFFERENT DOSES OF RADIATION ON THE TOTAL GREASE CONTENT IN CORN. Velazquez D. R. (Universidad Autonoma de Queretaro (Mexico). Escuela de Ciencias Quimicas). 1974. 78p. (In Spanish). INIS.

Thesis.

The present work is a part of the project on the disinfestation of corn by irradiation. Because it is necessary to demonstrate that the irradiated corn does not undergo alterations in its composition or its organoleptic properties, preliminary studies were instituted to develop analytical techniques for the various components of corn. A brief description is given of the physical and chemical aspects which have the greatest relation with the effect of the irradiation dose on the total content of oil in corn. (tr-INIS)

15042 INFLUENCE OF AGENTS THAT ENHANCE LETHAL EFFECTS OF RADIATION ON THE DAMAGE TO BACTERIAL MEMBRANES BY X RAYS AND ULTRAVIOLET LIGHT. Cancelliere, G.; Giacchi, P.; Misiti-Dorello, P.; Quintiliani, M. (Istituto Superiore di Sanita, Rome). Radiat. Res.; 64: No. 3, 593-601(Dec 1975).

Radiation damage to the cell membrane of E. coli B/r was evaluated by the release of intracellular K^+ ions as a function of radiation dose. It was found that x-ray-induced K^+ loss was (i) not affected by the presence of oxygen; (ii) enhanced by sodium iodide (NaI), iodoacetic acid (IAA), iodopropionic acid (IPA), and iodoacetamide (IAM) when cells were irradiated while in equilibrium with air; (iii) still enhanced by NaI, but not by IAM, when cell suspensions were bubbled with N_2 or O_2 before and during irradiation; (iv) decreased by N-ethylmaleimide (NEM) under any irradiation conditions. It was also found that both NEM and iodine-containing compounds protected cells from membrane damage caused by exposure to uv light. Parallel experiments carried out on cell survival confirmed the lack of correlation between the damage responsible for the loss of intracellular K^+ and that responsible for cell killing. (auth)

15043 RADIATION-INDUCED INCREASED MELANOSIS IN CRUSTACEAN SHELLFISH. Savagaon, K. A.; Sreenivasan, A. (Bhabha Atomic Research Center, Bombay). Radiat. Res.; 64: No. 3, 624-632(Dec 1975).

Radiation-induced increased melanosis in the lobster shell system was investigated. Irradiation was found to increase melanosis by accelerating the conversion of prephenoloxidase into active form during subsequent storage through activation of the prephenoloxidase-activating enzyme, by increasing the rate of release of tyrosine and by enhancing the reactivity of tyrosine shortening, at the same time, the lag period of enzyme reaction. (auth)

15044 STERILIZATION OF SPICES BY MEANS OF γ RAYS. Inal, T.; Keskin, S.; Tolgay, Z.; Tezcan, I. (Ankara Univ. (Turkey). Inst. for Nutrition Control and Hygiene; Istanbul Univ. (Turkey). Inst. for Nutrition Hygiene and Technology; Institute for Nuclear Research, Ankara (Turkey)). Fleischwirtschaft; 55: No. 5, 675-677(May 1975). (In German).

2 figs.; 2 tabs.; 4 refs.

The authors used ground paprika, black pepper, and caraway (Cuminum Cyminum) and irradiated them in stages using ^{60}Co. The effect of irradiation on the total aerobic count and on sulphite-reduced clostridia was determined by quantitative total counts. Changes in flavor, aroma, and color and losses in essential oils were taken into account. It was found that irradia-

tion with 0.8 to 1.0 Mrad ensured a satisfactory reduction in the number of organisms in the ground spices used. (DE)

15045 FURTHER STUDIES ON THE RADIORESISTANCE OF HIGHLY PURIFIED MOUSE AND MAMMARY TUMOR VIRUS. Gorka, C. (CEA Centre d'Etudes Nucleaires de Grenoble, France); Mouriquand, J. Eur. J. Cancer; 11: No. 6, 397-402(Jun 1975).

The effects of high doses of γ rays, ranging from 1080 to 3960 kR, on cell free extracts from mammary tumors and highly purified MTV are compared. Mammary tumor occurrence as well as latency in BALB/c inoculated mice are not affected by the high doses used. Dilutions from 10^{-2} to 10^{-5} of irradiated samples are not followed by a decrease of biological activity, even at the dilution of 10^{-5} which is characterized by a drop in the mammary tumor-inducing capacity of the non-irradiated control specimen. The incubation with ribonuclease crystalline (RNase), desoxyribonuclease (DNase) and pronase B grade (pronase) does not affect the biological activity of irradiated samples. Ultrastructural examination of irradiated virus suspensions shows very rare remnants of MTV compared to the typical aspect of the non-irradiated virus. (auth)

15046 EFFECTS OF GAMMA RADIATION ON THE PHYSICAL PROPERTIES OF SOME SOUTH AFRICAN VARIETIES OF POTATOES. Winchester, R. V. (Atomic Energy Board, Pelindaba, Pretoria (South Africa). Chemistry Div.). Atomkernenergie; 26: No. 2, 117-121(1975).

4 figs.; 21 refs.

Effects of gamma irradiation on the mass loss, specific gravity, firmness, sprouting, and rotting of five varieties of potatoes grown in South Africa have been studied. Doses of up to 15 krad inhibit sprouting without detrimental effects on other physical properties, and the culinary properties are expected to be unaffected. Excessive mass loss, shrinkage, and rotting found in some varieties are ascribed to unsuitable storage conditions rather than to irradiation. (DE)

15047 YEAST STRAIN FOR SIMULTANEOUS DETECTION OF INDUCED MITOTIC CROSSING OVER, MITOTIC GENE CONVERSION AND REVERSE MUTATION. Zimmermann, F. K.; Kern, R.; Rasenberger, H. (Technische Univ., Darmstadt, Ger.). Mutat. Res.; 28: No. 3, 391-398(Jun 1975).

A diploid yeast strain of Saccharomyces cerevisiae is described which can be used to study induction of mitotic crossing-over, mitotic gene conversion and reverse mutation. Mitotic crossing-over can be detected visually as pink and red twin-sectored colonies which are due to the formation of homozygous cells of the genotype ade2-40/ade2-40 (deep red) and ade-2-119/ade2-119 (pink) from the originally heteroallelic condition ade2-40/ade2-119 which forms white colonies. Mitotic gene conversion is monitored by the appearance of tryptophan nonrequiring colonies on selective media. The alleles involved are trp5-12 and trp5-27 derived from the widely used strain D_4. Mutation induction can be followed by the appearance of isoleucine non-requiring colonies on selective media. D_7 is homoallelic ilvI-92. The isoleucine requirement caused by ilvI-92 can be alleviated by true reverse mutation and allele non-specific suppressor mutation. The effects of ethyl methanesulfonate (EMS), nitrous acid, ultraviolet light and hycanthone methanesulfonate were studied with D_7 stationary phase cells. Mitotic crossing-over as monitored by red/pink twin-sectored colonies was almost equally frequent among normal and convertant cells. This showed again that mitotic recombination is not due to the presence of a few cells committed to meiosis in an otherwise mitotic cell population. The dose-response curves for induction of mitotic gene conversion and reversion of the isoleucine requirement were exponential. In contrast to this, the dose-response curve for induction of twin sectored red and pink colonies reached a plateau at doses giving about 30% cell killing. This could partly be due to lethal segregation in the progeny of treated cells. None of the agents tested would induce only one type of mitotic recombination, gene conversion or crossing-over. There was, however, some mutagen specificity in the induction of isoleucine prototrophs. (NL)

15048 RADIATION-SENSITIVE PYRIMIDINE AUXOTROPHS OF USTILAGO MAYDIS. I. Isolation and Characterization of Mutants. Moore, P. D. (National Inst. for Medical Research, London). Mutat. Res.; 28: No. 3, 355-366(Jun 1975).

The relationship between uv sensitivity and pyrimidine auxotrophy has been examined. Fourteen pyrimidine-requiring mutants have been classified on the basis of genetic complementation and utilization of biosynthetic intermediates and have been assigned to at least four loci. All the mutants studied were sensitive to uv, although the degree of sensitivity varied both between loci and amongst alleles at the same locus. A double mutant strain carrying pyrimidine mutants at two loci was only as sensitive to uv as the more sensitive of the singles. This suggests that both mutants are deficient in the same repair mechanism. Suppressor mutations which restored endogenous pyrimidine biosynthesis were isolated. These suppressors restored uv resistance in the presence of the original mutation. The results indicate that the uv sensitivity of these mutants is a direct result of pyrimidine auxotrophy and not to any secondary properties of the mutants. (NL)

15049 MUTATION AND DNA REPLICATION IN ESCHERICHIA COLI TREATED WITH LOW CONCENTRATIONS OF N-METHYL-N'-NITRO-N-NITROSOGUANIDINE. Jimenez-Sanchez, A.; Cerda-Olmedo, E. (Univ., Seville). Mutat. Res.; 28: No. 3, 337-345(Jun 1975).

N-methyl-N'-nitro-N-nitrosoguanidine (nitrosoguanidine) causes an unexpectedly high frequency of closely linked double mutants because of its specificity for chromosome regions in replication. Low nitrosoguanidine concentrations (1 μg/ml) in liquid cultures allow replication at the normal rate and are mutagenic. It was expected that mutations would be spread over the chromosome as it replicated, but a high frequency of closely linked double mutants was found. If a thymine auxotroph is grown in the presence of 5-bromodeoxyuridine (BUdR) and nitrosoguanidine and then exposed to 313-nm radiation (which destroys BUdR-substituted DNA), the mutation frequency is much higher among survivors than among non-irradiated cells. It is concluded that nitrosoguanidine inhibits DNA replication in a small fraction of the population and that mutations are induced in that same fraction. Nitrosoguanidine treatment leads to a high frequency of closely linked double mutants under all known conditions. (NL)

15050 REVERSIONS OF THE TWO MISSENSE AND ONE NONSENSE TRP$^-$ MUTATIONS INDUCED BY UV-LIGHT OR METHYL METHANESULFONATE IN E. COLI WILD TYPE AND ITS polAI AND uvrE502 MUTANTS. Skavronskaya, A. G.; Smirnov, G. B. (Gamaleya Inst. for Epidemiology and Microbiology AMS, Moscow). Mutat. Res.; 28: No. 3, 311-322(Jun 1975).

Two missense mutations, trpA58 and trpA78, and one nonsense mutation trp_{Ochre}, were used to determine the types of base-pair substitution caused by ultraviolet irradiation and methyl methanesulfonate (MMS) in Escherichia coli. UV irradiation of the wild-type bacteria led to the formation of revertants mainly arising as a result of GC yields AT transitions (suppressor revertants of the trpA58 mutant). True revertants of the trp$^-$ mutant (arising via transitions of AT pairs) and 5-methyl tryptophan-sensitive (MT^s) Trp$^+$ revertants of the trpA78 mutant (arising via unidentified transversions) occurred at a lower frequency. The polAI mutation did not change the frequency of the UV-induced transitions GC yields AT or that of the substitutions of the AT pairs. The uvrE502 mutation significantly increased the frequency of the UV-induced revertants arising via the transition GC yields AT. Treatment of the wild-type bacteria with MMS resulted in the formation of revertants mainly due to the GC yields AT substitution, and with a lower frequency to the AT yields GC transitions. MMS also induced some transversions with a low frequency. The frequency of the MMS-induced GC yields AT transition was enhanced in the uvrE502 mutant. On the other hand, the uvrE502 mutation eliminated or significantly lowered MMS-induced revertants arising as a result of AT yields GC transitions or transversions. (NL)

15051 SENSITIVITY OF USTILAGO MAYDIS TO PYRAZOPHOS AND ONE OF ITS CONVERSION PRODUCTS, AND FAILURE TO INDUCE RESISTANCE WITH UV-TREATMENT. Georgopoulos, S. G. (Democritus Nuclear Research Center, Athens); Geerligs, J. W. J.; Dekker, J. Neth. J. Plant Pathol.; 81: No. 1, 38-41(1975).

2-hydroxy-5-methyl-6-ethoxycarbonylpyrazolo(1,5-a)pyrimidine (PP), a conversion produce of pyrazophos, shows considerable toxicity to Ustilago maydis when administered to this fungus in a solution at pH 5. Evidence was obtained that U. maydis may convert pyrazophos into PP, and that the latter compound is the toxic principle responsible for the action of pyrazophos. By UV-irradiation of sporidia, no PP-resistant mutants were obtained. This does not support the hypothesis that this toxicant acts by specific inhibition of one enzyme system. (NL)

15052 UPTAKE OF ^{3}H THYMIDINE AND CELL DNA SYNTHESIS DURING THE EARLY MULTIPLICATION PHASE OF HERPES VIRUS HOMINIS IN BKH CELLS. Bittlingmaier, K.; Schneider, D.; Falke, D. (Univ., Mainz). Biochim. Biophys. Acta; 407: No. 4, 384-391(4 Nov 1975).

Experiments about the interaction of herpes viruses with BHK-cells during the first 6h after infection concerning uptake and incorporation of dThd have been reported. During adsorption and penetration, the inhibition of uptake and of incorporation of [3H]dThd is sensitive to heat, but not to ultraviolet irradiation or cycloheximide. The eclipse is characterized by a strongly

increased uptake of [3H]dThd and by inhibition of cell DNA synthesis. Both are sensitive to ultraviolet irradiation of the particles and cycloheximid treatment of the cells. It is concluded that the events during adsorption and penetration are dependent on the particles themselves, whereas the events during the eclipse depend on the activity of the viral genome. The implications of the findings are discussed. (NL)

15053 STUDY OF GENETIC EFFECTS OF HIGH ENERGY RADIATIONS WITH DIFFERENT IONIZING CAPACITIES ON EXTRACELLULAR PHAGES. Bresler, S. E. (Leningrad Inst. of Nuclear Physics); Kalinin, V. L.; Rybchin, V. N.; Kopylova, Yu. I.; Kriviskii, A. S.; Shelegedin, V. N. Mutat. Res.; 29: No. 1, 1-20(Jul 1975).

The inactivating and mutagenic action of high-energy radiations with different ionizing capacities (γ-rays, protons, α-particles and accelerated ions of ^{12}C and ^{20}Ne) was studied by using coliphages λ11 and s_D as subjects. In particular the role of irradiation conditions (broth suspension, pure buffer, dry samples) and of the host functions recA, exrA and polA was investigated. The dose-response curve of induced mutagenesis was studied by measuring the yield of vir mutants in λ11 and plague mutants in s_D. (NL)

15054 EXCISION OF PYRIMIDINE DIMERS FROM THE DNA OF MUTANT AND WILD-TYPE STRAINS OF USTILAGO. Unrau, P. (National Inst. for Medical Research, London). Mutat. Res.; 29: No. 1, 53-65(Jul 1975).

UV-induced pyrimidine dimers were excised from the DNA of wild-type and four mutant strains of Ustilago maydis. Excision was partially dose dependent. The kinetics of excision differed in recombination deficient strains (rec 1 and rec 2) from those found in a recombination proficient radiation-sensitive strain (uvs 3). At fluences above 100 J.m-2 excision was saturated in uvs 3 but not in rec 1 or rec 2. Fluences above 300 J.m-2 started to saturate excision in wild-type. Poll-1, a temperature-sensitive DNA polymerase mutant, was excision proficient at both the permissive (22°) and restrictive (32°) temperatures. Wild-type cells were observed to excise CC before CT or TT in high dose experiments. (NL)

Radiation Effects on Plants

15055 (INTA-TR-111) USE OF ATOMIC ENERGY IN PLANT BREEDING. Outstanding mutations. Ryan, G. (Instituto Nacional de Techologia Agropecuaria, Pergamino (Argentina). Estacion Experimental Regional Agropecuaria). Feb 1972. 8p. (In Spanish). INIS.

From 8th Latin American meeting of plant breeding; Bogota, Colombia (22 Nov 1970).

An elementary review on mutation techniques in plant breeding is given. Spontaneous mutations were used until induction of mutations was feasible through many chemicals and physical agents able to modify germ plasm. Though efficiency in their utilization has been increased it is not yet possible to have a controlled process of mutation production and detection. This technique is not always advisable in breeding plants if employed species or crops do not fulfil some conditions. It is considered that the discipline named "Mutation Breeding" does not exist independently; it is one chapter of "Breeding" in a broad sense. 93 different crops (51 cereals and vegetables) have been obtained, up to the end of 1970, by direct or indirect employment of mutations.

15056 BRIEF REPORT OF INDUCED MUTATION BREEDING OF BEAUVERIA BASSIANA (BALS) VUILL. Wei Sheng Wu Hsueh Pao; 2: No. 2, 10-11(May 1975). (In Chinese).

Mutation of Beauveria bassiana (Bals.) Vuill. was induced with Cobalt $^{60}\gamma$ rays before artificial selection to breed superior strains. The experimental results reported in this paper proved that the technique is feasible for adoption in production. The genetic stability of the mutants remains a subject for future study, however. Production from the selective breeding of the mutants and the pesticidal effects of the final products are reviewed. (JPRS)

15057 MITOTIC CROSSING-OVER AS AN IMPORTANT MECHANISM OF FLORAL SECTORING IN TRADESCANTIA. Christianson, M. L. (Michigan State Univ., East Lansing). Mutat. Res.; 28: No. 3, 389-395(Jun 1975).

A purple flowered Tradescantia hirsuticaulis is described exhibiting three classes of somatic sectors: red-only, red/blue twin spots, and blue-only. The twin spots are shown to be the results of a single event since the association of red and blue cells in the same stamen is non-random and intervening purple cells occur far too infrequently to permit hairs containing both red and blue sectors to arise by sequential, facilitated, red-only and blue-only events. As in T. clone 02, deletion, as evidenced by the presence of micronuclei (chromosome fragments), is indicated to be one mechanism producing some kinds of sectors (red-only) in response to ionizing radiation. The predominant, if not exclusive, mechanism of spontaneous sectoring and important mechanism of even 60 R-induced sectoring in this T. hirsuticaulis (and by inference, in other Tradescantia) is argued to be mitotic crossing-over, since other mechanisms operating on its genotype do not allow for twin spots arising as the result of one event. This is supported by the prediction of all three types of sectors in the proper order of frequency as well as by the calculation of a "coefficient of coincidence" and a radiation response that are similar to those found for mitotic crossing-over in Drosophila. (NL)

Radiation Effects on Animals

Man

Refer also to abstracts 14299 and 14828.

15058 (N-75-12573) PROTON TISSUE DOSE FOR THE BLOOD FORMING ORGAN IN HUMAN GEOMETRY: ISOTROPIC RADIATION. Khandelwal, G. S.; Wilson, J. W. (National Aeronautics and Space Administration, Langley Station, Va. (USA). Langley Research Center). Dec 1974. 21p. (NASA-TM-X] 3089; L-9628). NTIS $3.25.

A computer program is described which calculates doses averaged within five major segments of the blood forming organ in the human body taking into account selfshielding of the detailed body geometry and nuclear star effects for proton radiation of arbitrary energy spectrum (energy less than 1 GeV) and isotropic angular distribution. The dose calculation includes the first term of an asymptotic series expansion of transport theory which is known to converge rapidly for most points in the human body. The result is always a conservative estimate of dose and is given as physical dose (rad) and dose equivalent (rem). (STAR)

15059 (N-75-14404) FUNCTION OF THE BODY AND FACTORS OF SPACE FLIGHT. Gurovskii, N. N. (ed). 1974. Translation of Funktsiya Organizma i Faktory Kosmicheskogo Poleta, Meditsina Press, Moscow, 1974. (NASA-TT-F-15971). 342p. NTIS $9.50.

Various aspects of artificial cabin atmospheres, human thermoregulation, hypodynamia, vestibular stability, and radiation safety during manned space flight are elaborated. (STAR)

15060 (SAAS-180) OCCUPATIONAL RADIATION EXPOSURE IN THE GDR IN 1972. Koenig, W.; Larssen, A.; Rothe, W. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). [nd]. 42p. (In German). Dep. NTIS (US Sales Only) $4.00.

In 1972 a total of 33,928 occupationally exposed persons were monitored by the central film badge service of the National Center for Radiation Protection. The monthly over-exposures (more than 0.4 rad) totalled 538. In 18 cases the quarterly dose (3 rad) was exceeded during one month and for 14 of these records could be assessed as real over-exposures. Most of the over-exposures could be attributed to an insufficient application of safety regulations. The results were analyzed according to type of institution, type and duration of employment, as well as age of employees. (auth)

15061 TREATMENT OF CARCINOMA OF THE PANCREAS WITH RADON SEED IMPLANTATION AND INTRA-ARTERIAL INFUSION OF 5-FUDR. Barone, R. M. (Univ. of Illinois, Chicago). Surg. Clin. North Am.; 55: No. 1, 117-126(Feb 1975).

This review has the shortcomings of any retrospective uncontrolled study and one should not conclude that the procedures described offer better palliation with less morbidity and mortality than present attempts at cure and palliation of this disease. At present, surgical resection offers the best chance of cure and palliation. However, the dismal results of surgical therapy make imperative the establishment of additional protocols with new therapeutic approaches, which include and combine the use of high dose external and interstitial radiation, systemic and regional chemotherapy, immunotherapy, and surgery. Radon seed implantation is able to provide high dose cancericidal radiation with relatively few side effects. Concomitant chemotherapy, both regional and systemic, can therefore be given with less fear of additive toxicity from therapeutic levels for control of disseminated microscopic foci of disease. (auth)

15062 RADIATION DOSE MEASUREMENTS IN INTRAVENOUS PYELOGRAPHY. Egeblad, M.; Gottlieb, E. Ann. Radiol.; 18: No. 4, 321-324(1975). (In English, French)

Intravenous pyelography (IVP) and micturition cystourethrography (MCU) are the standard procedures in the radiological examination of children with urinary tract infections and in the control of these children. Gonad protection against radiation is not possible in MCU, but concerning the girls partly possible in IVP. It is of major importance to know the radiation dose in these procedures, especially since the examination is often repeated in the same patients. All IVP were done by means of the usual technique including possible gonad protection. The thermoluminescence dosimeter was placed rectally in the girls and fixed on the scrota in the boys. A total of 50 children was studied. Gonad dose ranged from 140 to 200 mR in the girls and from 20 to 70 mR in the boys (mean values). The radiation dose in IVP is very low compared to that of MCU, and from this point of view IVP is a dose saving examination in the control of children with urinary tract infections. (FR)

15063 IMPLANTATION OF ^{125}I IN PROSTATIC CANCER. Whitmore, W. F. Jr.; Hilaris, B.; Grabstald, H.; Batata, M. (Sloan-Kettering Cancer Center, New York). Surg. Clin. North Am.; 54: No. 4, 887-895(Aug 1974).

A technique of interstitial irradiation of the prostate using a ^{125}I gamma source is described. Preliminary results with this treatment are reported and some apparent advantages and disadvantages of the method are discussed. This technique has been utilized only in selected patients with carcinoma of the prostate and a controlled study of comparable patients treated by alternative methods has not been carried out. (CH)

15064 AFTERLOADING AND RADIUM SUBSTITUTES. Simon, N. (Mount Sinai School of Medicine, New York). Gynecol. Oncol.; 2: No. 3, 324-330(1974).

The Heyman packing technique is the most useful intracavitary method of irradiating endometrial cancer. The main disadvantage of the classical Heyman technique is the unnecessary exposure of personnel to radiation. Substitution of radium by cesium-137 permits afterloading. The endometrial cavity can be packed with hollow tubes with bulbous ends dimensionally similar to Heyman applicators, but able to be afterloaded with miniaturized sources of cesium-137. Afterloading reduces exposure of personnel to radiation, allows more accurate placement of radioactive material, and permits better teaching of the procedure. (auth)

15065 EVOLUTION OF RADIOTHERAPEUTIC TECHNIQUES. Brady, L. W.; Lewis, G. C. Jr.; Antoniades, J.; Prasasvinichai, S.; Torpie, R. J.; Asbell, S. O.; Glassburn, J. R.; Schatanoff, D.; MacMurray, T. (Hahnemann Medical Coll. and Hospital, Philadelphia). Gynecol. Oncol.; 2: No. 3, 314-323(1974).

Adenocarcinoma is the most common kind of tumor involving the uterine corpus, occurring in a frequency of 90 percent or better and found predominantly in post-menopausal women. Because of vaginal bleeding, diagnosis is made early and control rates are good. Regional lymph node metastases are found to occur in about 20 percent of all operable patients and more frequently in those with advanced lesions near the cervix. Surgery alone fails not only because of metastases but also because of persistence in the vaginal vault and in the periurethral region. From a theoretical and practical viewpoint, preoperative irradiation is a valuable and important role in the treatment of carcinoma of the endometrium. Treatment calls for a technique that will effectively irradiate the uterine tissue, the vaginal vault, and and the immediate extrauterine tissues in which postsurgical persistence is known to appear. From the standpoint of survival, both preoperative external therapy and preoperative radium therapy are effective with equivalent survival figures. The incidence in our experience of vaginal recurrence in those patients who were irradiated preoperatively with external beam therapy techniques would indicate the need for supplemental radium within the vaginal vault. (auth)

15066 ROLE OF POSTOPERATIVE IRRADIATION IN CARCINOMA OF THE ENDOMETRIUM. Goodman, R.; Hellman, S. (Harvard Medical School, Boston). Gynecol. Oncol.; 2: No. 3, 354-361(1974).

The role of adjunctive irradiation in the management of Stage I carcinoma of the endometrium is reviewed. Primary surgical management is accepted therapy. Less certain is the use, type, and timing of adjunctive irradiation. The data indicate that irradiation decreases the incidence of vaginal recurrence and improves survival. The type and timing of irradiation is uncertain; however, we favor intracavitary irradiation primarily, with external beam therapy added for the enlarged uterus, poorly differentiated histology, and myometrial invasion. An outline of the timing of intracavitary or external irradiation in the various clinical circumstances is included. (auth)

15067 GONAD SHIELDING IN DIAGNOSTIC RADIOLOGY. DHEW Publication (FDA) 75-8024. Rockville, MD; Department of Health, Education, and Welfare (1975). 22p. GPO.

The use of gonad shielding is an important radiation protection technique, intended to reduce unnecessary x-ray exposure of the gonads of patients from diagnostic x-ray procedures. The types of gonad shields in use are discussed as are the types of diagnostic examinations that should include gonad shielding. It was found that when properly used, most shields provided substantial gonad dose reductions. (ERB)

15068 REPORT OF BOARD III: RADIATION DOSES AND RADIATION EFFECTS. Muth, H. pp 125-131 of Progress Report of the Safety Commission of the Federal Ministry of the Interior for the Year 1973. Bonn, F. R. Germany; BMI (1973). (In German)

The papers report on studies of aerosol precipitation in the human respiratory system, on the biological effects of inhaled radioactive aerosols, on radiation effects, and on the recovery from radiation damage. (DE)

15069 ORDINANCE ON THE AVOIDANCE OF INJURIES FROM X-RAYS. X-Ray Ordinance. Bundesgesetzblatt, Teil 2; 1973: No. 18, 173-188(Mar 1973). (In German).

This decree gives the requirements and regulations for the operation of x-ray equipment, especially for the treatment of living humans with x-ray radiation. It contains directions for the permissible radiation load and other regulations for safe operation and for the medical control of persons occupationally exposed to radiation. (DE)

15070 GAS-TIGHT SUIT FOR PROTECTION AGAINST TOXIC OR RADIOACTIVE GASES AND DUST PARTICLES AND THEIR RADIATION. Schnurr, W. (to Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (F. R. Germany)). German(FRG) Patent 1,610,628/B/. 17 Apr 1975. 2p. (In German)

Gas-tight suits are worn as a protection against toxic or radioactive gases and dust particles. They are fitted with respirators and a device to discharge the used air. On the back of the suit there is a chamber which acts in a pressure-regulating way. This chamber is connected with the inside of the suit via an overflow mechanism and can be blown up with air or it can be contracted through its elastic links. These suits can also be worn in an atmosphere of cover gases, e.g. argon or helium. (GE)

15071 TABLE FOR THE RAPID DETERMINATION OF RET AND TDF VALUES. Webber, B. M.; Simpkins, G. S. (Rhode Island Hospital, Providence). Br. J. Radiol.; 48: No. 575, 929-930(Nov 1975).

A table has been devised to allow rapid determination of the RET and time dose fractionation factors (TDF) values for five-day a week therapy schemes which might be included in realistic treatment planning. The table allows easy comparison of the RET and TDF values for different fractionation schemes or, conversely, the devising of equivalent fractionations for similar RET and TDF values. Utilizing the decay tables of Orton and Ellis (Orton, C. G., and Ellis, F., 1973, Br. J. Radiol., Vol. 46, 529), the table may be used for rapid determination of the total TDF for interrupted or split course treatment regimens. The table could easily be modified for application to four-day a week therapy schemes. (auth)

15072 DRUG FOR RADIATION DISEASES. (to Spitalul Clinic Filantropia-Bucuresti). Netherlands Patent 7,403,637/A/. 19 Mar 1974. 7p. (In Dutch)

A description is given of a mixture of organic compounds that can be administered intravenously to humans who have received a high dose of ionizing radiation. If administered within four hours after the radiation dose has been received, the mixture, to a certain extent, prevents radiation syndromes that lead to lethality. (NL)

15073 REVIEW OF STUDIES IN THE USSR ON THE POSSIBLE BIOLOGICAL EFFECTS OF SOLAR ACTIVITY. Gauquelin, M.; Gauquelin, F. (Laboratoire d'Etudes des Relations Entre Rythemes Cosmiques et Psychophysiologiques, Paris). J. Interdiscip. Cycle Res.; 6: No. 3, 249-252(Sep 1975).

Vertebrates

Refer also to abstract 15037.

15074 EFFECT OF SINGLE VERSUS FRACTIONATED DOSES OF X RADIATION ON INCISORS IN RATS. Horn, Y.; Markitziu, A.; Ulmansky, M. (Hebrew Univ., Jerusalem). J. Dent. Res.; 54: No. 2, 378-383(1975).

This study compares the effect of single vs fractionated doses of x radiation on the incisor of the rat. The results showed that

fractionated doses are more damaging than a single dose and that three fractionated doses have a stronger effect than five. (auth)

15075 SELECTIVE RADIOSENSITIZATION OF THE HYPOXIC CELLS OF MOUSE TUMORS WITH THE NITROIMIDAZOLES METRONIDAZOLE AND Ro 7-0582. Brown, J. M. (Stanford Univ., CA). Radiat. Res.; 64: No. 3, 633-647 (Dec 1975).

A study was made of the effect of two nitroimidazoles, metronidazole and the Roche product Ro 7-0582, on the radiosensitivity of the EMT6 mouse tumor. Both drugs at the high concentration of 1.0 and 1.2 mg/g (metronidazole and Ro 7-0582, respectively) reduced the slope of the resistant portion of the tumor cell survival curve. The radiosensitization was maximum at 30 min after intraperitoneal injection, and was gradually lost during the next 6 hr. Experiments performed to determine the degree of radiosensitization as a function of amount of Ro 7-0582 injected showed near-maximum radiosensitization of the hypoxic cells (as judged by the slope change of the resistant portion of the cell survival curve) at concentrations above 0.1 mg/g. At these concentrations dose modification factors for the hypoxic tumor cells (DMF) of approximately 2.5 were obtained. A tumor control study with the MDAH/MCa4 mammary carcinoma confirmed both the high DMF (equals 2.3) at high Ro 7-0582 concentration, and the lack of a large reduction in the DMF (greater than 1.8) when the concentration was reduced to 0.3 mg/g. There was some cytotoxicity at the high drug doses. Concentrations of Ro 7-0582 of both 0.3 and 1.0 mg/g radiosensitized the normal skin at doses of 3000 rad and above, presumably due to lack of full oxygenation of this tissue. (auth)

15076 CURE OF A SOLID TUMOR BY SIMULTANEOUS ADMINISTRATION OF MICROWAVES AND X-RAY IRRADIATION. Yerushalmi, A. (Weizmann Inst. of Science, Rehovot, Israel). Radiat. Res.; 64: No. 3, 602-610 (Dec 1975).

An ionizing radiation therapy technique that enables simultaneous local irradiation and heating of the tumor is described. Microwave energy was used to generate heat within the tissues in order to sensitize a radiation resistant tumor. The system was tested on F_1 mice bearing an SV-40 fibrosarcoma in the limb. In successive experiments four types of treatment were compared: (1) control, only anesthetized; (2) heat treatment alone (intratumor temperature of 44°C); (3) radiation alone (800 R); (4) combined treatment by simultaneous heating and x irradiation. These treatments were given once or twice. No cure was observed by heat treatment alone. A small delay and a few cases of cure resulted by radiotherapy alone. Combined microwave-heating and x irradiation treatment given once at an early stage of tumor growth resulted in cures of 20 percent of the mice. When given twice, simultaneous heating and x irradiation cured 80 percent of recipients. (auth)

15077 ACCUMULATION OF alpha-AMINOISOBUTYRIC ACID BY RAT TISSUES AFTER WHOLE-BODY gamma-IRRADIATION. Kilberg, M. S.; Neuhaus, O. W. (Univ. of South Dakota, Vermillion). Radiat. Res.; 64: No. 3, 546-554 (Dec 1975).

Previous studies demonstrated a stimulated AIB transport in the liver of rats after whole-body gamma irradiation. The present work is an expansion of those studies and reports that the irradiation-stimulated, hepatic transport is time-related and dose-dependent. The uptake was followed for the first 72 hr after exposure to a range of doses between 500 and 2500 R. The transport increased over the entire 72 hr investigated between the 500 and 1500 R levels; that at 1500 R being increased 400 percent at 72 hr postirradiation. At the 2000 and 2500 R doses the uptake increased 200 to 300 percent, reaching a maximum at 48 hr after exposure. During the next 24 hr the AIB accumulation at both of these doses decreased, with that at 2500 R declining to normal values and that at 2000 R being slightly higher. Whole-body irradiation also resulted in an elevated accumulation of AIB in the kidney. Maximal uptake occurred 48 hr postirradiation for all doses. At 72 hr the accumulation declined to near or below control values for all doses except 250 and 500 R. The AIB transports for three other tissues, spleen, testes, and muscle were not stimulated by whole-body irradiation. The mechanism by which this amino acid transport system is stimulated remains to be established. (auth)

15078 BIOCHEMICAL EFFECTS OF X-RADIATION ON THE RETINA OF THE ALBINO RABBIT. Newton, J. C.; Barsa-Newton, M. C.; Jacobson, J. H.; Krohn, D. L. (New York Eye and Ear Infirmary, NY). Radiat. Res.; 64: No. 3, 518-523 (Dec 1975).

The effects of x radiation on the oxygen consumption, anaerobic glycolysis, cytochrome oxidase, succinic, lactic, and malic dehydrogenase activities of the rabbit retina were investigated. These activities were inhibited by over 50 percent when 7000 rad were administered. The only exception was anaerobic glycolysis, which was only inhibited by 13 percent. With higher doses of x radiation, the toxic effects rose proportionately with the dose. (auth)

15079 ENHANCEMENT OF RADIATION RESPONSE OF A MURINE MAMMARY CARCINOMA BY TWO NITROFURAN DERIVATIVES. Stone, H. B.; Withers, H. R. (Univ. of Texas, Houston). Radiat. Res.; 64: No. 3, 443-451 (Dec 1975).

Two nitrofuran derivatives, NF-131 [1-(5-nitro-2-furyl)-3-piperidino-1-propanone semicarbazone hydrochloride], and nifuroxime (anti-5-nitro-2-furaldoxime), have been tested for their effect on the TCD50 of a C3H mouse mammary carcinoma and on murine jejunal epithelium. NF-131, at a dose of 2 mg/mouse, caused a reduction in the TCD50 by a factor of 1.21 to 1.23 when administered iv 3, 10, or 30 min before irradiation. This drug dose had no effect on tumor growth and only a minimal effect on the radioresponse of jejunal epithelium, but caused death in about 3 percent of the mice. Nifuroxime, at a dose of 0.05 mg/g body weight, reduced the TCD50 by a factor of 1.36 when administered ip 10 min before irradiation, but was lethal for 22 percent of the mice. A dose of 0.10 mg/g enhanced the tumor radioresponse by a factor of 1.48 when administered 10 min before irradiation, but by lesser factors at 3 and 30 min. This dose was lethal to 37 percent of the mice. Both doses of nifuroxime inhibited tumor growth temporarily, but neither enhanced the radioresponse of jejunal epithelium. (auth)

15080 IMMUNOTHERAPY WITH NEURAMINIDASE-TREATED TUMOR CELLS AFTER RADIOTHERAPY. Song, C. W.; Levitt, S. H. (Univ. of Minnesota, Minneapolis). Radiat. Res.; 64: No. 3, 485-491 (Dec 1975).

The effect of active immunotherapy with Vibrio cholerae neuraminidase-treated syngeneic tumor cells (VCN-cells) following radiotherapy has been studied with 3-methylcholanthrene-induced fibrosarcoma, M-79, transplanted to the thigh of C3H/HeJ mice. When the tumors reached 4 to 8 mm in diameter, various treatments were started. X-irradiation with 2000 rad in a single dose induced a complete regression of 24 out of 103 tumors (23.3 percent). The inoculation of 1 x 10^6 of VCN-cells to the tumor-bearing animals, every other day for a total of three doses, caused a complete regression of 6 out of 57 tumors (10.5 percent). Treatments of animals with the immunotherapy starting 1 day after X-irradiation of tumors with 2000 rad resulted in a complete regression of 22 out of 58 tumors (37.9 percent). The median survival time of animals that received combined radiotherapy and immunotherapy was longer than that observed after either treatment alone. (auth)

15081 DESIGN OF AN EXPERIMENT TO STUDY LEUKEMOGENESIS IN MICE IRRADIATED BY ENERGETIC HEAVY IONS. Patrick, J. W.; Stephens, L. D.; Thomas, R. H.; Kelly, L. S. (Univ. of California, Berkeley). Radiat. Res.; 64: No. 3, 492-508 (Dec 1975).

The design of an experiment to study the incidence of cancer and hematological effects in mice irradiated by heavy ions is described. A beam of fully stripped C^{6+} ions of energy 250 MeV/amu was produced by the Bevatron. Mice were irradiated in groups of 12 by rotating them in a wide beam (11.4 cm FWHM) once per minute. At a beam intensity of 10^8 ions per pulse irradiations of 250 animals to absorbed doses of 200 rad were completed in a few hours, an efficient use of accelerator beam time. The average LET of the radiation was 16.6 keV/mu m with a spread in the animal of +-2 keV/mu m. Radial and longitudinal variations in absorbed dose were less than 30 percent and 15 percent, respectively. Estimates of tissue-entrance absorbed doses with an ionization chamber and with thermoluminescent dosimeters differed by less than 3 percent. (auth)

15082 VASCULARIZATION AND INNERVATION OF IRRADIATED, TRAUMATIZED MUSCLE DURING STIMULATION OF THE REPAIR PROCESS BY TRANSPLANTING PULVERIZED MUSCLE TISSUE. Popova, M. F.; Azarova, V. S. Arkh. Anat. Gistol. Embriol.; 68: No. 1, 92-97 (Jan 1975). (In Russian).

The purpose of the study was the study of muscle tissue components and their interaction during stimulation of the post-traumatic regeneration of irradiated traumatized muscle by pulverized muscle tissue. Particular attention was devoted to vascular vessels and nerve elements, which play an important role in the recuperation of muscle as a contractile organ. The study was carried out on 60 white rats of both sexes. In the experimental series of animals the right extremity was given a dose of 2000 R. After irradiation under nembutal narcosis a radial cut of the calf muscle was made on the right extremity, and pulverized muscle tissue taken from the left, unirradiated extremity was transplanted into the cut. It is shown that transplantation of actively regenerating muscle, tissue not only promotes the recuperation of irradiated muscle, but also, as a rule, prevents the formation of a skin ulcer which does not heal. Transplantation of pulverized muscle tissue into the radial muscle cut so stimu-

lated the recuperation of the irradiated muscle that the regeneration process differs only slightly from regeneration of nonirradiated muscle. (INIS)

15083 ECOLOGICAL PROBLEMS IN THE REPRODUCTION OF WILD RODENTS AND CONTAMINATION OF THE HABITAT WITH ^{90}Sr. Isaev, S. I. (Inst. of Evolutionary Morphology and Animal Ecology, Moscow). Sov. J. Ecol. (Engl. Transl.); 6: No. 1, 33-37(1975).

Translated from Ekologiya; 6: No. 1, 46-51(1975).

Over a period of two years in two areas artificially contaminated with ^{90}Sr and in two control areas we investigated changes in the population, fertility, and embryonic mortality of rodents, most of which were wood mice (Mus silvaticus). We investigated the relationship of fertility and embryonic mortality to numbers in the population; also the effect of contamination with ^{90}Sr. (auth)

15084 NATURAL RADIOPROTECTORS. Kovaleva, G. K. (Chemical Sciences, Moscow). Priroda; No. 3, 101-102(1975). (In Russian).

In in vitro studies utilizing mammalian tissue cultures showed that peptic hydrolysates of some grasses, e.g., saltwort, exerted a radioprotective effect. In addition, feeding grasses, that constitute the normal diet of Mongolian gerbils known for their radioresistance, to rats kept in a vivarium increased the radioresistance of the latter. Use of Orostachus spinosa in combination with other grasses in the diet showed a radioprotective effect equivalent to that obtained with cystamine. (JPRS)

15085 EFFECT OF IRRADIATION UPON GASTRIC SECRETION OF ADRENALECTOMIZED RATS. Groza, P.; Gheorghe, N.; Stefan, M.; Boerescu, J. Rev. Roum. Physiol.; 10: No. 6, 435-440(1973).

In experiments on rats the role of adrenals was studied in the gastrosecretory effect produced by irradiation (500 R). It was demonstrated that adrenalectomy produces the disappearance of postirradiation gastric hypersecretion. Concomitantly it was observed the disappearance of gastric pepsin hypersecretion produced by irradiation. The disappearance of pepsin increase after adrenalectomy may be explained by lack of glucocorticoids. Concomitantly it was noted a net decrease of the high catecholamine secretion that follows the irradiation, especially that of adrenaline, a fact which may in part explain the modification of gastrosecretory postirradiation response after adrenalectomy. (auth)

15086 SIMPLE METHOD FOR DOSE MEASUREMENTS IN A BIOLOGICAL IRRADIATION FACILITY. Zarand, P. (National Research Inst. for Radiobiology and Radiohygiene, Budapest). Acta Biochim. Biophys. Acad. Sci. Hung.; 8: No. 2, 111-115 (1973).

The influence of reactor poisoning and burning up on the dose rate was investigated in mice irradiated in a biological irradiation facility operated at the research reactor in the Central Research Institute for Physics, Budapest. A simple method based on continuous monitoring is described which permits a more precise planning of experiments and their intercomparison than either activation technique or ionization method. (auth)

15087 CHORIORETINAL BURN: BODY TEMPERATURE DEPENDENCE. Ward, B.; Bruce, W. R. (Technology Inc., San Antonio). Ann. Ophthalmol.; 3: 898-899(Aug 1971).

Irradiance thresholds for chorioretinal damage in rhesus monkeys vary linearly with core temperatures between 34 and 39°C. Damage results from the combined thermal effects of retinal irradiation and the body temperature. Visible damage is calculated to occur at a tissue temperature of 42.5°C. Fever increases the retina's susceptibility to burns from the sun, lasers, and other radiant energy sources. (auth)

15088 RESTING STAGES OF THE JB-1 ASCITES TUMOR IN THE IRRADIATED MOUSE. Bichel, P.; Dombernowsky, P. (Radivmstationen for Jylland, Denmark). Eur. J. Cancer; 11: No. 6, 425-431(Jun 1975).

The present study of the JB-1 ascites tumor in immuno-suppressed mice (subjected to 400-rad whole-body irradiation 24 hr before inoculation) was undertaken in order to investigate the role of a possible immune reaction against the tumor cells for the accumulation of Q_1 and Q_2 cells. The experimental data, viz. growth curve, and continuous labelling experiments combined with cytophotometry, showed, first, identical growth of the tumors in the irradiated and non-irradiated mice and, secondly, preserved accumulation of Q_1 and Q_2 cells in the irradiated mice. These non-cycling cells re-entered the cell cycle after removal of most of the tumor in the plateau phase, or after transplantation of cells from plateau tumors to new hosts. The present results, which are identical with those previously obtained with the tumor carried by normal mice, lend further support to the assumption that the accumulation of non-cycling cells in the ageing JB-1 ascites tumour is of a non-immunological nature. (auth)

15089 DAMAGE AND RECOVERY ASSESSMENT OF THE MOUSE JEJUNUM TO ABDOMINAL X-RAY AND ADRIAMYCIN TREATMENT. Burholt, D. R.; Hagemann, R. F.; Cooper, J. W.; Schenken, L. L.; Lesher, S. (Allegheny General Hospital, Pittsburgh). Br. J. Radiol.; 48: No. 575, 908-912(Nov 1975).

The influence of adriamycin on the post-irradiation proliferative response of the mouse jejunum was examined. Doses of either 5 or 10 mg/kg of adriamycin administered immediately after abdominal irradiation reduced the $LD_{50/7\ days}$ by 300 to 400 R. Neither dosage of the drug reduced the number of surviving crypts, as measured by the crypt isolation and microcolony techniques, for a given radiation exposure. However, both drug dosages reduced the amount of post-irradiation compensatory hyperplasia, as measured by ^{3}H-thymidine incorporation. (auth)

15090 APPLICATION OF THE WEIBULL DISTRIBUTION TO SOME INSTANCES OF CELL SURVIVAL, OF NEOPLASTIC SURVIVAL, AND OF AGEING. Campos, J. L. (Univ. of Michigan, Ann Arbor). Br. J. Radiol.; 48: No. 575, 913-917(Nov 1975).

The Weibull distribution has been applied to several processes of survival with either increasing, decreasing, or constant hazard rate. In cases of survival where shoulder and exponential segments have been postulated the Weibull distribution seemed to fit them. (auth)

15091 SCANNING TRANSMISSION PROTON MICROSCOPY OF HUMAN METAPHASE CHROMOSOMES AT LOW RESOLUTION: NO CATASTROPHIC DAMAGE. Escovitz, W. H.; Fox, T. R.; Levi-Setti, R. (Univ. of Chicago). Ultramicroscopy; 1: No. 1, 79-82(Jul 1975).

15092 INDUCTION OF CHROMATID DELETIONS IN ACCORD WITH THE BREAKAGE-AND-REUNION HYPOTHESIS. Wolff, S.; Bodycote, J. (Univ. of California, San Francisco). Mutat. Res.; 29: No. 1, 85-91(Jul 1975).

In the present experiments it has been possible to study large numbers of X-ray induced chromatid deletions, or breaks, in Chinese hamster chromosomes and to discern whether or not a sister chromatid exchange also occurs at the point of breakage. Chromatid deletions are only infrequently associated with a sister chromatid exchange. This is contrary to the expectations derived from the exchange hypothesis of Revell. On the basis of this hypothesis, in which chromatid deletions are considered to be incomplete exchanges that occur in the necks of little loops in the chromosomes, 40% of the chromatid breaks are expected to be associated with sister chromatid exchanges. The present data are in accord with the conclusions drawn from the earlier autoradiographic experiments of Heddle and Bodycote, and show that chromatid breaks can be accounted for on the basis of the breakage-and-reunion hypothesis, with the majority being simple breaks and some being incomplete exchanges between two such breaks. (NL)

15093 X-RAY INDUCED DOMINANT LETHAL MUTATIONS IN MATURE AND IMMATURE OOCYTES OF GUINEA-PIGS AND GOLDEN HAMSTERS. Cox, B. D.; Lyon, M. F. (Medical Research Council, Harwell, Eng.). Mutat. Res.; 28: No. 3, 421-436(Jun 1975).

The induction of dominant lethal mutations by doses of 100-400 rad X-rays in oocytes of the guinea-pig and golden hamster was studied using criteria of embryonic mortality. For both species higher yields were obtained from mature than from immature oocytes. Data on fertility indicated that in the golden hamster immature oocytes were more sensitive to killing by X-rays than mature oocytes but that the converse was true in the guinea-pig. The dose-response relationship for mutation to dominant lethals in pre-ovulatory oocytes of guinea-pigs and golden hamsters was linear, both when based on pre- and post-implantation loss only. The rate per unit dose was higher for the golden hamster, and the old golden hamsters were possibly slightly more sensitive than young ones. (NL)

Invertebrates

Refer also to abstract 15027.

15094 (INIS-mf-1857, pp 53-67) MEIOTIC DISJUNCTION AND EMBRYONIC LETHALITY IN TRISOMICS DERIVED FROM AN X-LINKED TRANSLOCATION IN THE ONION FLY, HYLEMYA ANTIQUA (MEIGEN). van Heemert, C. 27 Mar 1975.

This chapter has been published in Chromosoma, v. 47 (1974) p. 237-251.

In chromosomal rearrangements in the onion fly Hylemya antiqua (Meigen), induced and isolated for genetic insect control purposes. Studies on cytogenetics and fertility, with emphasis on an X-linked translocation.

Translocation- and tertiary trisomics (for the X-chromosomes)

were obtained after testcrossing translocation heterozygous females of an X-linked "simple" translocation stock. Meiotic disjunction as judged from segregations at M II (mules) and in young eggs of testcrosses (males and females) in translocation trisomics was studied. No progeny of tertiary trisomic males and females was found, but male M II could be studied. Six different orientation types appeared in translocation trisomic (2n + 1) males and these were present in equal frequencies. No adjacent II configurations were found. The small X- and Y-chromosomes and the large translocated X-chromosome of the translocation complex disjoin at random (n and n + 1 gametes) in both translocation and tertiary trisomic males. In translocation trisomic females four different orientation types appeared. From the high frequency of two of these (together, 94.5%) it is concluded that the two normal X-chromosomes show preferential pairing and disjunction, while the translocated X-chromosome moves to either one of the two poles at random. Primary trisomic (for the X-chromosome) males (XXY) and females (XXX) were obtained from test-crossed translocation trisomics. Cytological analysis of adult male progeny of testcrossed XXY males showed that no random orientation for the X-, X- and Y-chromosomes occurred because half of the sons were disomic (XY) and half of them trisomic (XXY). A possible mechanism is discussed. Analysis of young eggs of testcrossed XXX females indicated a segregation of 2X : 1X = 1 : 1. The level of "semi"-sterility as scored from testcrosses of translocation trisomics appeared to be as in translocation heterozygotes. Here again a close relation exists between "semi"-sterility and deficiencies in eggs for a large chromosomal segment. The possible use of this translocation for genetic control of insect pests is discussed. (INIS)

15095 CORN EARWORMS: QUALITY OF SPERM IN STERILE MALES RELEASED FOR POPULATION SUPPRESSION ON ST. CROIX ISLAND. North, D. T.; Snow, J. W.; Haile, D.; Proshold, F. I. (Dept. of Agriculture, Fargo, ND). J. Econ. Entomol.; 68: No. 5, 595-598(15 Oct 1975).

Randomly selected radiosterilized male Heliothis zea (Boddie) released on the island of St. Croix were examined in the laboratory and found to have sperm of poor viability and quality. Sperm from native males was more viable and fragmented less than sperm from the laboratory-reared males during storage in the spermatheca whether the males were crossed with laboratory or native females. None of 65 laboratory-reared females found remating in the field contained a normal appearing quantity of unfragmented sperm or normal motility. Thus, both sperm quantity and quality influenced remating in the corn earworm female.

15096 CAUSES OF DEATH IN IRRADIATED ADULT INSECTS. Ducoff, H. S. (Univ. of Illinois, Urbana). Biol. Rev.; 47: 211-240(May 1972).

Studies on biological radiation effects are reviewed under the following headings: mammalian lethal syndromes; other effects of radiation in mammals; units of dose and other physical considerations; acute lethality in irradiated insects; the time-course of mortality; intestinal damage; effects on mechanisms of disease resistance; and changes in the life-span of irradiated insects. (HLW)

Radionuclide Effects (Internal Source)

Man

Refer also to abstract 14828.

15097 (LF-tr-103) COLLAGEN BIOSYNTHESIS IN THE LUNGS OF RATS WITH RADIATION INJURY. Tseveleva, I. A. Translated from Vopr. Med. Khim.; 20: 640-643(1974). 8p. Dep. NTIS $3.50.

Biosynthesis of collagen proteins in the sclerosis process in the lungs during injury by plutonium is being studied. It is shown that an accumulation of collagen in lung fiber is the result of increasing biosynthesis of the given protein. The increase in content of soluble fractions of collagen of the lungs and more intense inclusion of H^3-proline [2-pyrrolidinecarboxylic acid] in the collagen are evidence of this. (auth)

15098 PLUTONIUM CONTROVERSY. Sagan, L. A. (Palo Alto Medical Clinic, CA). J. Am. Med. Assoc.; 234: No. 12, 1267-1268(22 Dec 1975).

Controversy has swirled around a number of issues related to nuclear energy, but ultimately the pivotal and most urgent question is that of possible human effects. To some, concern about Pu in particular has been so great that they would abort or even dismantle the entire nuclear program for electrical generation. Yet the hazards of Pu are no greater than those of many other industrial substances. The experience of 30 years supports the contention that Pu can be used safely. Data that support this statement are reviewed. (CH)

15099 THORIUM INDUCED HEPATIC HEMANGIOENDOTHELIOMA. Roentgen-Angiographic Findings in Two Additional Cases with Clinical "Inform and Consent" Problems. Curry, J. L.; Johnson, W. G.; Feinberg, D. H.; Updegrove, J. H. (Easton Hospital, PA). Am. J. Roentgenol., Radium Ther. Nucl. Med.; 125: No. 3, 671-677(Nov 1975).

Two additional cases of presumed, thorium-induced hemangioendothelioma of the liver are reported. The angiographic pattern of large venous lakes conforms closely to the pathologic descriptions of this malignancy. To our knowledge, angiography of the thorotrast (and vinyl chloride) liver, before the clinical evolution of malignancy, has not been recorded and may provide information of prognostic and therapeutic value. Incidental identification of thorium deposits in the tissues of clinically healthy patients creates perplexing inform and consent problems. Presumably, these must be solved on an individual basis. Because the use of thorotrast has been discontinued since the early 1950s, all physicians reviewing chest and abdominal roentgenograms should be aware of the characteristic appearance of human thorotrast deposits, especially in the liver, spleen and celiac lymph nodes. The number of living thorotrast carriers and previous deaths from thorotrast related malignancy seems highly uncertain at this time. (auth)

15100 REDKOZEMEL'NYE ELEMENTY: RADIATSIONNO-GIGIENICHESKIE ASPEKTY. (Rare Earth Elements: Radiation-Hygiene Aspects). Andreeva, O. S.; Kiselev, V. I.; Malinina, V. I. Moscow; Atomizdat (1975). 152p.

Rare earth elements are widely used in various branches of industry. Processing of radioactive ores and concentrates to separate the rare earth elements may be accompanied by the accumulation of radioisotopes in the intermediary products and wastes, which necessitates evaluating radiation effect factors and developing protective and prophylactic measures. The book discusses the biological effects of rare earth elements and radioactive impurities on the body, danger factors, problems of industrial hygeine, and prophylactic and protective measures. Problems in the determination of the contamination level of the air with aerosols of Ac, ^{210}Pb, ^{230}Th, and others and the laws governing the contamination of the air with Ac, Th, and their daughter products are studied. Problems of sanitary and dosimetric control are considered for different types of ore processing. Generalization from large amounts of factual data indicated measures for ensuring radiation and general safety. (227 references) (tr-auth)

15101 RADIATION DAMAGE AFTER ENDOLYMPHATIC THERAPY WITH RADIOISOTOPES. Jentzsch, K.; Wolf, G. (Univ., Vienna). Verh. Dtsch. Ges. Kreislaufforsch.; 56: 443-448(1972). (In German).

For therapeutic purposes radioisotopes ^{32}P, ^{131}I, or ^{198}Au combined with an oily contrast media are administered lymphatically. The distribution of Lipiodol ^{32}P is described. The morphological picture of the lymph node after high dosage irradiation is mentioned. Reviewed are the side effects and complications observed in our patients and those published in the literature. Mainly local reactions occur after disturbances of the lymphatic flow. In these cases stenoses of the ureter also must be taken into account. Sometimes reversible amenorrhoea occurs. Very rare are side-effects on lung and liver. (auth)

15102 USE OF ^{125}I FOR INTERSTITIAL IMPLANTS. Hilaris, B. S.; Holt, G. J.; Germain, J. S. Rockville, MD; Department of Health, Education, and Welfare (1975). 42p.

The use of iodine-125 seeds for the implant irradiation of malignant tumors was investigated in terms of efficacy and radiological safety. Studies over a 3-year period at the Memorial Hospital for Cancer and Allied Diseases in New York were supported by the Bureau of Radiological Health. The final report indicates that iodine-125 is a satisfactory substitute for the high energy gamma emitters used in interstitial irradiation. Tumor doses of 16,000 rads were tolerated without undesirable early side effects. Methods for routine calibration of seeds and determination of dose distribution within patients were developed. A theoretical value for the absorbed dose constant of iodine-125 was computed. Personnel monitoring of hospital staff and survey of patients with sources in situ showed a marked reduction in exposure from these sources. Disadvantages were noted in the difficulty of locating lost sources and need to shield patients after discharge.

Animals

15103 RESPONSE OF FEMORAL AND VERTEBRAL COLONY-FORMING UNITS TO ^{226}Ra INTERNAL CONTAMINATION IN MICE. Svoboda, V.; Kofranek, V. (Inst. of Hygiene and Epidemiology, Prague). Radiat. Res.; 64: No. 3, 467-474(Dec 1975).

In mice given intraperitoneally 0.034 mu Ci of ^{226}Ra/g body weight the peripheral blood counts, marrow cellularity in femora and lumbar vertebrae, and the colony counts and ^{59}Fe uptake in spleens of heavily irradiated hosts after grafting either femoral or vertebral myeloid cells were determined. In mice treated with 0.030 mu Ci of ^{226}Ra/g the activity per 10 mg of wet bone tissue was computed and the data obtained in femoral ends and diaphyses and in lumbar vertebrae were correlated to the hematological findings. The effect of internally retained ^{226}Ra is manifested by serious changes in femoral and vertebral hemopoiesis and in peripheral blood counts. The vertebral marrow is more seriously damaged as observed in the colony counts and ^{59}Fe uptake in recipient spleens. This unequal response of femoral and vertebral marrow is discussed in relation to the ^{226}Ra activity retained and the area of endosteal surfaces. (auth)

Plants

15104 TRITIATED-THYMIDINE INDUCED CHANGES IN CELL POPULATION KINETICS IN ROOT MERISTEMS OF PISUM SATIVUM. Stetka, D. G.; Webster, P. L. (Univ. of Massachusetts, Amherst). Radiat. Res.; 64: No. 3, 475-484(Dec 1975).

The effects of ^{3}H-thymidine on cell progression through the mitotic cycle and on cell population kinetics have been investigated. During continuous treatment there is a gradual inhibition of entry of cells from G2 into mitosis, while other stages of the cell cycle appear to be less radiosensitive. Hence there is an accumulation of cells in G2 while the proportions of cells in G1, S, and M decrease. Cells of the quiescent center are induced to synthesize DNA after inhibitions of mitosis in the surrounding meristem. They do not serve to repopulate the meristem, however, since they then incorporate ^{3}H-thymidine and are themselves arrested. It is suggested that the other slowly cycling cells of the meristem, in addition to those of the quiescent center, may also be induced to cycle more rapidly after delay in the fast-cycling population. These cells will also be arrested after a brief compensatory proliferative reaction. Thus the meristem is unable to recover from radiation damage during continuous treatment with ^{3}H-thymidine. (auth)

Nuclide Kinetics and Toxicology

Man

Refer also to abstract 14299.

15105 (HASL-299) GENERAL POPULATION EXPOSURE OF STABLE LEAD AND ^{210}Pb TO RESIDENTS OF NEW YORK CITY. Bogen, D. C.; Welford, G. A.; Morse, R. (Energy Research and Development Administration, New York (USA). Health and Safety Lab.). Dec 1975. 19p. Dep. NTIS $3.50.

Stable lead and ^{210}Pb intake, ingestion, and inhalation by residents of New York City were determined. Measurement of excreta samples provided data to establish a mass balance of stable lead and ^{210}Pb. These results indicate that no more than 5 mu g of stable lead and 0.1 pCi of ^{210}Pb are retained daily by residents of New York City. Analyses of bone samples have provided estimates of the skeletal burden of stable lead and ^{210}Pb. Using the ICRP model, intake data, and assuming 100 percent skeletal deposition, the calculated stable lead and ^{210}Pb values are in good agreement with the experimental results. The data indicate that inhalation is the principle source of stable lead to residents in New York City. (auth)

Animals

15106 METABOLISM AND TOXICITY OF CADMIUM, MERCURY, AND LEAD IN ANIMALS: A REVIEW. Neathery, M. W.; Miller, W. J. (Univ. of Georgia, Athens). J. Dairy Sci.; 58: No. 12, 1767-1781(Dec 1975).

Cadmium, mercury, and lead are toxic to humans and animals. Although cadmium and inorganic mercury toxicities occur in humans, they have not been observed in domestic livestock under practical conditions. In contrast, cattle, especially young calves, are extremely susceptible to lead toxicity. Apparently, cattle are more tolerant of cadmium than are other animal species. Due partially to higher absorption and longer retention times in the body, the alkyl mercuries, especially methyl mercury, are more toxic than inorganic mercury compounds. Inorganic forms of cadmium, mercury, and lead are poorly absorbed from the intestine. However, due to lack of effective homeostasis, after absorption retention time is long. Injected cadmium, mercury, and lead are metabolized differently from that naturally absorbed. Most cadmium and mercury are in kidney and liver (50 and 23 percent of total body in goats); but highest total load of methyl mercury is in muscle (72 percent in cows). With low to moderate body burden, most lead is retained in the skeleton. However, beyond a certain point, the kidney accumulates large quantities. Only minute amounts of cadmium and mercury are secreted into milk, but milk is only moderately well protected from dietary lead. Likewise, little cadmium and inorganic mercury pass the placental barrier whereas lead and methyl mercury pass more readily. (auth)

15107 AS IMPROVED APPARATUS FOR SINGLE INHALATION EXPOSURE OF MINIATURE SWINES TO RADIOACTIVE AEROSOLS. Pusch, W. M. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Vienna. Forschungszentrum). Atomkernenergie; 26: No. 2, 125-128(1975). (In German).

7 figs.; 12 refs.

In the Institute for Biology of the Austrian Research Centre at Seibersdorf the retention of inhaled radioactive aerosols in the organism of miniature swines is studied. In this publication the equipment is described which is used for this inhalation experiment and which consists of the following main parts: an airtight breathing mask, a special frame for fixing the test animals and a plexiglass box which seals the swines in during the experiment; and the air-aerosol mixture container and the aerosol generator for which the most safety attention was taken by enclosing them in a low pressure hot cell. (DE)

15108 DISTRIBUTION OF AN ^{125}I-LABELLED CHLOROQUINE ANALOGUE IN A PREGNANT MACACA MONKEY. Dencker, L.; Lindquist, N. G.; Ullberg, S. (Uppsala Univ.). Toxicology; 5: No. 2, 255-264(Nov 1975).

Whole body autoradiography of a pregnant monkey (Macaca irus) of late gestation was performed 72 h after an intravenous injection of the ^{125}I-labelled chloroquine analogue 4-(3-dimethylaminopropylamino)-7-iodoquinoline (DAPQ). The overall distribution pattern in the monkey was similar to that which was earlier observed in rodents. A few species differences, however, were found in the monkey as compared to the rodents: a high accumulation in the inner part of the adrenal cortex, a high level in the central nervous system, and generally a higher retention in the tissues. The accumulation in the cortex may be of significance for the cortisone-like effects of the 4-aminoquinolines in rheumatoid arthritis and allied conditions. The fact that no accumulation was found in the adrenal cortex of mice and rats indicates that these species may not be appropriate in studies on the mechanisms involved in the anti-inflammatory action of the 4-aminoquinolines. As was earlier observed in small rodents the melanin containing structures accumulated the drug. In both the mother and the fetus a high concentration was thus seen in the uveal tract of the eye, in the inner ear (in the stria vascularis of the cochlea and the planum semilunatum of the ampullae) and in the hair follicles. This accumulation can be related to reported disturbances — also transplacentally induced — in vision and hearing. (NL)

New Tracer Techniques

Refer also to abstracts 14231, 14339, 14882, 14883, 14887, 14902, 14903, 14912, 14984, and 15040.

15109 (FRNC-TH-554) CONTRIBUTION TO THE ULTRASTRUCTURAL STUDY OF SILK-EXCRETION CELLS AND AUTORADIOGRAPHIC ANALYSIS OF INTRACELLULAR FIBROIN TRANSPORT IN BOMBYX MORI L. Couble, P. (Lyon-1 Univ., 69 (France)). 1974. vp. (In French). INIS.

It is much easier to study the mechanisms involved in the synthesis and exportation of extracellular proteins if the biological material chosen is highly differentiated. The silk-excretion gland of the silkworm is ideal in this respect because during the larva period, especially at the end of the 5th and last stage, the cells at the rear (excreting tube) synthesize and export massive quantities of a single protein: fibroin. These phenomena were explored by a cytological study carried out mainly by electron microscopy and autoradiography. The results obtained are given. They relate first of all to the morphological development of the secretion tube cells from the end of the 4th larva stage

to the spinning of the cocoon, and contribute new information on the cell changes during the 4th slough and the end of the 5th age. They also concern intracellular fibroin transport which is proved to take place through the Golgi apparatus, and finally the possible role of the microtubules and microfilaments in fibroin transport and secretion. On this last point the results so far constitute only a preliminary approach which justifies no final conclusions; they merely suggest that the microfilaments of the apical region are involved in the secretion process. (FR)

15110 (LBL--3872) AXIAL TOMOGRAPHY AND THREE DIMENSIONAL IMAGE RECONSTRUCTION. Chang, L. T.; Macdonald, B.; Perez-Mendez, V. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Nov 1975. Contract W-7405-Eng-48. 8p. (CONF-751116--20). Dep. NTIS $3.50.

From nuclear science symposium; San Francisco, California, USA (17 Nov 1975).

A number of existing gamma cameras for imaging of radioisotope distributions give depth information about the distribution. These devices have in common that they provide tomographic images of the object, that is, that images of a given object plane have that plane in focus and all other object planes contribute an out-of-focus background superimposed on the in-focus image. A method is described for three dimensional reconstruction of these axial tomographic images which removes the blurred off-plane activity from a number of transverse planes simultaneously. The method is applicable to a number of tomographic cameras, such as the multiple single-pinhole camera, the rotating slanted-hole collimator, the Anger focussing tomographic scanner, and the positron camera. The method can be implemented on a small computer having a disc system. (auth)

15111 (N-75-17082) STUDY OF BONE MINERAL METABOLISM. Final Report, 1 July-31 December 1974. Palmer, H. E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 13 Jan 1975. Contract NAS9-14248. 17p. (NASA-CR-141608). NTIS $3.25.

The use of Sr-85 as an indicator of the skeletal location and relative amount of bone demineralization which occurs during immobilization of the body or body parts, bed-rest or space flight was studied. The bone mineral replacement which occurs after immobilization was measured rather than the bone loss which occurs during immobilization. In a study with two adult beagle dogs, the Sr-85 uptake in a leg which had been immobilized for two months was 400 percent higher than the uptake in the legs in regular use. This increased uptake probably resulted from only a few percent loss in bone mineral and indicates that losses less than one percent can be easily detected and located. The sensitivity, simplicity, and low radiation dose associated with the use of this method indicates that it should receive consideration for use on humans in bed-rest and space flight studies. Methods for measuring changes in total body nitrogen and in assisting the Johnson Space Center in calibrating a whole body counter for total body potassium measurements were also investigated. (STAR)

15112 (STI/DOC-10/170) ROOT ACTIVITY PATTERNS OF SOME TREE CROPS. Technical Reports Series No. 170. Results of a Five-Year Coordinated Research Program of the Joint FAO/IAEA Division of Atomic Energy in Food and Agriculture. Nethsinghe, D. A.; Broeshart, H. (International Atomic Energy Agency, Vienna (Austria)). 1975. 152p. IAEA $9.00.

Using a ^{32}P solution soil injection technique, seasonal root activity was studied. In most of the crops, root activity was highest near the soil surface, within the top 20 cm. The exceptions were orange trees in Spain, in which root activity was highest at 30 cm depth, and the dry season root activity of coffee in Kenya which was highest at 45 to 75 cm depth. In general, banana, young orange trees in Spain, mature coffee and coconut trees showed highest lateral root activity within 30 to 100 cm distance from the trees. In young citrus trees in Taiwan, mature orange in Spain, mature cocoa and oil palm trees in Malaysia, lateral root activity was highest at 100 to 300 cm distance. In the Ivory Coast the lateral root activity of mature oil palms was independent of distance from the tree within the 100 to 400 cm distance tested. In wet and warm seasons all crops showed more intense root activity than in dry and cold seasons. In dry weather, the differences between root activity near the soil surface and lower depths were less than in wet seasons. There were no marked seasonal variations in patterns of root activity. Experimental data indicate that patterns of root activity can vary with soil type, tree variety and age. These are some areas for future research. Fertilizer placement experiments using ^{32}P labeled fertilizers on coconut, citrus, cocoa and coffee trees showed that application within the zones of highest root activity resulted in highest utilization by both the treated tree and neighboring trees. (auth)

15113 (TID-26975) BIOLOGICAL EFFECTS OF RADIATION AND RELATED BIOCHEMICAL AND PHYSICAL STUDIES, NOVEMBER 1, 1974-SEPTEMBER 30, 1975. (Sloan-Kettering Inst. for Cancer Research, New York (USA)). 1975. Contract E(11-1)-3521. 140p. (COO-3521-166; COO-3521-167; COO-3521-168). Dep. NTIS $7.00.

Separate abstracts were prepared for the three sections of this progress report. (SFL)

For abstracts of individual sections see: 15030, 15114, and 15115.

15114 (TID-26975, pp vp, Paper 1) PRODUCTION OF RADIONUCLIDES, LABELED COMPOUNDS AND FAST NEUTRON BEAMS. Laughlin, J. S.; Tilbury, R. S.; Kuo, T. Y. T.; Gelbard, A. S. 1975.

In biological effects of radiation and related biochemical and physical studies, November 1, 1974-September 30, 1975. (Sloan-Kettering Inst. for Cancer Research, New York (USA)).

Progress is reported on the cyclotron-production of short-lived radioisotopes for use in clinical diagnostic studies. Radiopharmaceuticals labeled with ^{18}F, ^{11}C, ^{13}N, and ^{75}Se were tested for use in scanning bone tissues, the brain, and mammary glands for the localization of neoplasms and ^{14}O was used in metabolic studies. (CH)

15115 (TID-26975, pp vp, Paper 3) METABOLIC STUDIES IN CANCER WITH RADIOACTIVE ISOTOPES. Laughlin, J. S.; Myers, W. P. L. 1975.

In biological effects of radiation and related biochemical and physical studies, November 1, 1974-September 30, 1975. (Sloan-Kettering Inst. for Cancer Research, New York (USA)).

Progress is reported on the use of cyclotron-produced radioisotopes for use in clinical diagnostic studies. Radiopharmaceuticals labeled with ^{15}O, ^{11}C, ^{206}Bi, ^{111}In, ^{67}Ga, or ^{37}Ar were tested for the localization of neoplasms, ^{13}N was testes for use in metabolic studies, and ^{52}Fe was tested for use as a tracer for the diagnosis of hemic and skeletal diseases. (CH)

15116 METABOLISM OF 1-^{14}C LINOLENIC ACID IN DEVELOPING BRAIN. II. Incorporation of Radioactivity from 1-^{14}C Linolenate into Brain Lipids. Dhopeshwarkar, G. A.; Subramanian, C. (Univ. of California, Los Angeles). Lipids; 10: No. 4, 242-247(1975).

Metabolism of 1-^{14}C linolenic acid was studied in growing animals by injecting the tracer intraperitoneally into 12-13 day old suckling rats and following up the results by sacrificing groups of animals at 8 hr, 48 hr, 15 day, and 45 day intervals. In the first 15 days, there was a greater decrease in radioactivity of brain total lipids compared to the later period, although the earlier age period is characterized by lipid deposition rather than breakdown. Results showed that 8 hr after the tracer phosphatidyl choline had the highest specific radioactivity. When the total phosphatidyl ethanolamine fraction was resolved into diacyl and alk-1-enyl species, it was found that radioactivity was not distributed evenly between the two species. There was a progressive increase in radioactivity of the alkenyl and a decrease in the diacyl species. Forty-eight hr after the tracer, however, the radioactivity of phosphatidyl ethanolamine increased and at 45 days remained slightly higher than phosphatidyl choline. Radioactivity of cholesterol, a result of synthesis from acetate undoubtedly derived from the breakdown of tracer linolenate, was also high 48 hr after tracer and remained high until 45 days. (auth)

15117 METABOLISM OF LINOLENIC ACID IN DEVELOPING BRAIN. I. Incorporation of Radioactivity from 1-^{14}C Linolenate into Brain Fatty Acids. Dhopeshwarkar, G. A.; Subramanian, C. (Univ. of California, Los Angeles). Lipids; 10: No. 4, 238-241 (1975).

Twelve-thirteen day old rats were given 1-^{14}C linolenic acid by intraperitoneal injection. Fatty acids were isolated from the brains of animals sacrificed at the end of 8 and 48 hr and 15 and 45 days. Eight hr after the tracer, radioactivity was found neither in 18:3 nor its end-product, 22:6, and palmitate was the most highly radioactive component. At longer intervals, 22:6 seemed to retain much of the radioactivity, whereas palmitate showed a precipitous decline in radioactivity. Initial oxidation of linolenate and sparing of the linolenate complexed with polar lipids are discussed. (auth)

15118 DESIGN OF DOUBLE LABEL RADIOISOTOPE EXPERIMENTS. Bransome, E. D. Jr. Methods Enzymol.; 40: 293-302 (1975).

The properties of radioisotopes commonly employed in tracer studies (^{3}H, ^{14}C, ^{35}S, ^{32}P, ^{125}I, and ^{131}I) are given. The maximum energies (E/sub max/) involved in their radioisotopic decay are a fair indication of whether one radioisotope in a sample may adequately be determined in the presence of another. Counting methods and sample preparation are also discussed. (ERB)

15119 IMMUNOCHEMISTRY OF HUMAN PLASMA HIGH DENSITY LIPOPROTEINS. Radioimmunoassay of Apolipoprotein A-II. Mao, S. J. T.; Gotto, A. M. Jr.; Jackson, R. L. (Baylor Coll., Houston, TX). Biochemistry; 14: No. 18, 4127-4131(9 Sep 1975).

Apolipoprotein A-II (ApoA-II) is a major apoprotein of human plasma high density lipoproteins (HDL). The apoprotein has two identical chains of known amino acid sequence; the chains are linked by a single disulfide bond. In the present study, we have developed a specific radioimmunoassay for apoA-II that provides a convenient and reproducible method for measuring 10-100 ng of apoprotein. The assay was based on the competition of apoprotein with isotopically labeled [^{125}I]apoA-II. Dioxane (52 percent) was used to separate antibody bound [^{125}I]apoA-II from the free apoprotein. The assay has enabled us to begin studies directed toward mapping-out of the antigenic reactive regions of apoA-II. It has also allowed us to determine the interrelationship between the lipid-binding sites and the antigenic sites of the molecule. The antigenic reactivity of apoA-II was approximately the same in HDL and phospholipid-apoA-II complexes as that of the free apoprotein. However, succinylation of apoA-II was associated with a marked decrease in antigenic reactivity. (auth)

15120 GALLIUM CITRATE ^{67}Ga ACCUMULATION IN PSEUDOMEMBRANOUS COLITIS. Tedesco, F. J.; Coleman, R. E.; Siegel, B. A. (Washington Univ., St. Louis). J. Am. Med. Assoc.; 235: No. 1, 59-60(5 Jan 1976).

The tendency for ^{67}Ga-citrate to localize in inflammatory lesions can provide an extremely useful, noninvasive test in the septic patient. As with any diagnostic test, associated conditions that can compromise the diagnostic value of ^{67}Ga scanning should be known. Results are reported for a patient with pseudomembranous colitis. (CH)

15121 LIMITATIONS OF BONE SCANNING IN CLINICAL ONCOLOGY. Loeffler, R. K.; DiSimon, R. N.; Howland, W. J. (Akron General Medical Center, OH). J. Am. Med. Assoc.; 234: No. 12, 1228-1232(22 Dec 1975).

Radioisotope bone scanning is frequently used as the major, and sometimes the only, diagnostic test for neoplasia in bone. While the evidence is convincing that bone scans are frequently more sensitive than roentgenographic bone surveys for detection of metastatic bone disease, there are false-negative results for a variety of reasons, and positive findings must be interpreted with caution. Scans also appear more limited than roentgenograms in their usefulness for evaluating changes in abnormal bone structure. Case histories and discussion are offered to indicate that usually both radioisotope bone scans and roentgenographic bone surveys should be obtained for initial screening and subsequent assessment of bone metastases. (auth)

15122 DISODIUM TETRACARBONYLFERRATE: A TRANSITION-METAL ANALOG OF A GRIGNARD REAGENT. Collman, J. P. (Stanford Univ., CA). Acc. Chem. Res.; 8: No. 10, 342-347(Oct 1975).

This account describes how antibodies specific for nicotine and its metabolites and for various prostaglandins and their metabolites have been used to develop sensitive RIA's for these compounds. Thus far, antibodies have been prepared and RIA's developed for at least 100 other compounds of pharmacological importance. It has been calculated that an individual animal has the potential to produce antibodies that can recognize 10^7 and perhaps up to 10^8 diverse immunodominant moieties. Nature, therefore, has provided the pharmacologist and synthetic chemist with an analytical system of extraordinary specificity that can be adapted to the quantitative determination of a wide variety of pharmacologically active molecules. It is clear that RIA will be an important analytical tool in research as well as in the clinical laboratory. (auth)

15123 TRIAL OF APPLICATION OF TECHNETIUM-POLYPHOSPHATE COMPLEXES FOR EVALUATION OF SARCOILIAC ARTICULAR CHANGES. Wojciechowski, J. M.; Filipowicz-Sosnowska, A.; Sadowska-Wroblewska, M. Reumatologia; 12: No. 3, 297-303(1974). (In Czech).

The authors describe a method of sacroiliac joints examination by means of polyphosphates labelled with technetium-99m administered intravenously to 7 patients in doses of 3 to 5 μCi. In three cases with supposed early sacroiliac lesions the method demonstrated in two patients increased accumulation of the isotope determined by a specially elaborated quantitative method. In two other patients with advanced sacroiliac lesions and in two cases of degenerative spinal changes radioactivity over the sacroiliac joints was normal. The paper is a preliminary communication and the investigations are being continued. (auth)

15124 ISOTOPIC TRANSIT IN THE CEREBROSPINAL FLUID VALUE OF ^{111}In AND RESULTS OF ITS USE IN THE STUDY OF MALFORMATIONS OF THE OCCIPITO-CERVICAL REGION. Moretti, J. L.; Comoy, J.; Robert, G.; Mathieu, E.; Galle, P.; Caron, J. P. (Hopital Henri-Mondor, 94-Creteil (France)). Nouv. Presse Med.; 4: No. 26, 1906-1950(28 Jun 1975). (In French)

Indium-111 DTPA has been used in more than 200 studies of isotopic transit in the cerebrospinal fluid since the beginning of 1973. The results obtained with this isotope in 15 cases of malformation of the occipito-cervical region, scanned after lumbar and intra-ventricular injection, represent an example of its usefulness. (FR)

15125 PERIPHERAL VASCULAR PERFUSION SCANNING. CORRELATION WITH THE ARTERIOGRAM AND CLINICAL ASSESSMENT IN THE PATIENT WITH PERIPHERAL VASCULAR DISEASE. Siegel, M. E.; Giargiana, F. A. Jr.; White, R. I. Jr.; Friedman, B. H.; Wagner, H. N. Jr. (Johns Hopkins Medical Inst., Baltimore). Am. J. Roentgenol., Radium Ther. Nucl. Med.; 125: No. 3, 628-633(Nov 1975).

Peripheral vascular perfusion scan during rest and reactive hyperemia does not necessarily offer the same information as the arteriogram or the clinical assessment of the peripheral pulses. The information obtained from the peripheral vascular perfusion scan offers potentially clinically useful information regarding the physiologic significance of various arterial lesions to the surgeon in selection of his therapeutic approach. The peripheral vascular perfusion scan uniquely and under varied physiologic conditions permits assessment of the effect of arterial disease on the distribution of perfusion within the extremity. The peripheral vascular perfusion scan is not in competition with, but is complementary to, arteriography and clinical assessment of the patient with peripheral vascular disease. (auth)

15126 EXPERIENCE IN PARATHYROID SCANNING. Arkles, L. B. (Repatriation General Hospital, Heidelberg). Am. J. Roentgenol., Radium Ther. Nucl. Med.; 125: No. 3, 634-639(Nov 1975).

In our experience, the low success rate of ^{75}Se parathyroid studies does not justify continuance of the test as a routine diagnostic procedure. The initial results using the /sup 99m/TcO_4^- – ^{131}I subtraction technique are encouraging but further experience is required in order to ascertain whether this procedure will justify a place as a routine test in the localization of parathyroid adenoma. (auth)

15127 RADIONUCLIDE STUDIES IN BRONCHOGENIC CARCINOMA OF THE HILUM. Scintigraphy and Tomography: Their Complementary Features. Ito, H.; Ishii, Y.; Sakamoto, T.; Suzuki, T.; Fujita, T.; Hamamoto, K.; Torizuka, K. (Kyoto Univ.) Am. J. Roentgenol., Radium Ther. Nucl. Med.; 125: No. 3, 640-650 (Nov 1975).

Thirty-eight cases with direct or indirect signs of hilar masses were investigated by roentgenologic, radioisotopic and surgical methods. Reasonable correlation between tomography and scintigraphy was confirmed, substantiating their complementary nature. Bronchogenic carcinoma of the central airways was most frequent among the hilar masses. Masses as well as other involvement of the bronchovascular structures of the hilum on conventional tomography were confirmed by the gallium-67 scan, and inhalation and perfusion scintigraphy. Some cases which simulated bronchogenic carcinoma were presented. Hilar masses without destruction of the bronchovascular structures showed normal inhalation and perfusion scintigrams with positive gallium-67 accumulation. These lesions were metastatic cancer, malignant lymphoma, and sarcoidosis. If these diseases involve the airways and the vessels of the hilum, differentiation from bronchogenic carcinoma may naturally be difficult. (auth)

15128 NEW ISOTOPE METHODS FOR ESTIMATING MILK INTAKE AND YIELD. Holleman, D. F.; White, R. G.; Luick, J. R. (Inst. of Arctic Biology, Fairbanks, AK). J. Dairy Sci.; 58: No. 12, 1814-1821(Dec 1975).

Two isotope tracer methods, based on the transfer of isotopic tracer via milk from a female to offspring, were developed for estimating milk intake of nursing offspring. One method depended upon the transfer of tritiated water from female to offspring in milk and simultaneous determination of water turnover of the offspring by deuterium oxide. The second method was based on the transfer of radiocesium from female to offspring in milk and required the use of whole body counting techniques for evaluating the radiocesium body burden of the offspring. Experiments evaluating the two methods were with hand-reared Holstein calves given fixed milk intake. The methods gave valid estimates of milk intake; estimates were within +- 2.5 percent of the actual intakes. The application and limitations of these methods for estimating milk intake and yield of other species are discussed. (auth)

15129 DETERMINATION OF A SEASONAL VARIATION IN THE FOOD EXCHANGES BETWEEN WORKER HONEYBEES (Apis mellifica ligustica S.) by Means of a Radioisotope. Dousult, P.; Roger, B.; Pain, J. (Institut National de Recherches Agronomiques (INRA), 91-Bures-sur-Yvette (France). Station de Recherches sur l'Abeille et les Insectes Sociaux). C. R. Hebd. Seances Acad. Sci., Ser. D; 280: No. 20, 2349-2352(26 May 1975). (In French)

Food exchanges have been studied during the whole year between workers of unknown age and 4-days old workers. Variations exist between both groups. The mean percentage of shared food is 27% in the group of honeybees of unknown age and 40% in the group of 4-days old workers with respect to the initial intake of the giver. The effect of the season appears among workers of unknown age particularly. (FR)

15130 CALCITONIN BIOSYNTHESIS: EVIDENCE OF A PRECURSOR. Moya, F.; Nieto, A.; Candela, J. L. R. (Consejo Superior de Investigaciones Cientificas, Madrid (Spain). Instituto Gregorio Maranon). Eur. J. Biochem.; 55: No. 2, 407-413(Jul 1975).

8 figs.; 34 refs.

Calcitonin biosynthesis has been studied in chicken ultimobranchial glands incubated in vitro in the presence of radioactive amino acids. The results obtained suggest the existence of a biosynthetic precursor of higher molecular weight or procalcitonin. This precursor has been identified by pulsechase experiments, molecular weight determinations, biological activity measurements and analysis of tryptic peptides. Its molecular weight is about 13,000 (calcitonin, about 3,500) as determined by polyacrylamide gel electrophoresis. Procalcitonin is present in small amounts in chicken ultimobranchial glands and it is biologically active in rats. (GE)

15131 INTERACTION OF A NON-HISTONE CHROMATIN PROTEIN (HIGH-MOBILITY GROUP PROTEIN 2) WITH DNA. Goodwin, G. H.; Shooter, K. V.; Johns, E. W. (Royal Cancer Hospital, London (UK). Inst. of Cancer Research; Chester Beatty Research Inst., London (UK)). Eur. J. Biochem.; 54: No. 2, 427-433(Jun 1975).

7 figs.; 9 refs.

The interaction with DNA of the calf thymus chromatin non-histone protein termed the high-mobility group protein 2 has been studied by sedimentation analysis in the ultracentrifuge and by measuring the binding of the ^{125}I-labelled protein to DNA. The results have been compared with those obtained previously by us for the interaction of high-mobility group protein 1 with DNA. Although the binding parameters are similar for these two proteins, high-mobility group protein 2 differs from high-mobility group protein 1 in that the former appears to change the shape of the DNA to a more compact form. The molecular weight of high-mobility group protein 2 has been determined by equilibrium sedimentation and a mean value of 26,000 was obtained. A low level of nuclease activity detected in one preparation of high-mobility group protein 2 has been investigated. (GE)

15132 METHOD AND DEVICE FOR THE EXAMINATION OF A BODY BY PENETRATING RADIATION. Gibbons, D. J. (to EMI Ltd., Haynes (UK)). German (FRG) Patent 2,432,305/A/. 30 Jan 1975. 9p. (In German)

This radiological method of examination of the tomographical section of a body uses radiation between 0.2 and 2.0 MeV which is deflected in the body. The body is irradiated with a thin, parallel beam of rays emitted by a radiation source. On the side of the body opposite to the radiation source, three circular banks for detectors are arranged in a plane. The plane is crossed perpendicularly by the axis of the incident beam while the detector banks are arranged concentrically with regard to the point of intersection of the beam and the plane. The angle of deflection of a scattered ray from the axis of the incident beam can thus be registered by one of the detectors. The energy of the deflected beam can also be measured so that the distance between the center of deflection in the body and the plane of the detector banks can be determined using the Compton scattering equation. The detectors used for the determination of the radiation energy contain Li-drifted Si or Ge, or CdTe. (GE)

15133 USAGE OF INDICATORY DOSES OF PHOSPHORUS-32 FOR DIAGNOSING QUESTIONABLE CASES AND CONTROL OF EFFECTIVITY OF X-RAY THERAPY FOR TUMORS OF EYELID SKIN. Panfilova, G. V.; Pakhomova, A. I.; Usov, N. O.; Guzarskaya, M. V. Oftal'mol. Zh.; 29: No. 7, 514-517(1974). (In Russian).

Clinical examination alone cannot always permit diagnosis of tumours of eyelid skin. Radioactive phosphorus (P-32) was used for examination of 95 patients with questionable diagnosis of tumour of eyelid skin. Of them, 64 patients were subjected to isotopodiagnostics before treatment and 31 patients after treatment, for the purpose of control. Of 64 patients examined before treatment in 55 patients isotopodiagnostics revealed signs indicating to malignancy, and in 9 patients it showed contrary evidence. However, in 6 of 9 patients biopsy detected cancer of eyelid skin. Thus, indicatory doses of phosphorus-32 proved helpful for determination of the presence of malignancy of tumours of eyelid skin in 90.1%. Radioactive phosphorus for control of therapeutic effectivity may be used not only after x-ray therapy, but after surgical interference as well. (auth)

15134 METABOLISM OF ^{14}C-DIAZINON BY GYPSY MOTH LARVAE. Ahmad, S.; Forgashi, A. J. (Rutgers-the State Univ., New Brunswick, NJ). J. Econ. Entomol.; 68: No. 5, 571-576 (15 Oct 1975).

The metabolic fate of diazinon in larvae of Porthetria dispar (L.) was determined using ^{14}C-ring-labeled material. Following a 4-h ingestion period, 28.7 percent of the total recovered activity was present as diazinon in the larvae and 0.2 percent in the feces at 1 hr; by 12 h these amounts had changed to 1.4 and 15.4 percent, respectively. The major transformation products were 2,isopropyl-4-methyl-6-pyrimidinol greater than diazoxon greater than hydroxydiazinon greater than 2-(2'-hydroxy-2'-propyl)-4-methyl-6-pyrimidinol. Small amounts of 5 additional products were detected but were not identified. Metabolism of topically applied diazinon was the same qualitatively as that of ingested diazinon, based on a comparison of chloroform-extractable metabolites, although quantitative differences were evident. The synergists 2,6-dichlorobenzyl-2-propynyl ether (GA4-282) and piperonyl butoxide (PB) altered the metabolism of diazinon (both ingested and topical doses) by apparently similar actions, resulting in a reduction in the formation of 2-isopropyl-4-methyl-6-pyrimidinol, hydroxydiazinon, and 2-(2'-hydroxy-2'-propyl)-4-methyl-6-pyrimidinol. (auth)

15135 IMPROVED TECHNIQUE FOR MEASURING ASSIMILATION EFFICIENCY BY THE ^{51}Cr-^{14}C TWIN TRACER METHOD. Wightman, J. A. (Oxford Univ.). Oecologia (Berlin); 19: No. 4, 273-284(1975).

A technique to measure assimilation efficiency was tested using third instar larvae of a Kenyan cetoniid, Pachnoda ephippiata (Gerst.) (Coleoptera, Scarabaeidae), fed on an artificial food medium labelled with ^{14}C-glucose and $^{51}CrCl_3$. The activity of both tracers in food and faeces was estimated from simultaneous counts of the beta emissions recorded by a liquid scintillation spectrometer. The scintillant solution, toluene—Triton X-100—PPO, extracted virtually all of the labelled tracers from 0.2 g samples of the agar-cellulose-water food medium. The calculated assimilation efficiency values for glucose increased from 50.2 percent to 78.6 percent over the 6 days following exposure to the labelled food. 90.8 percent of the total ^{51}Cr recovered was egested during these 6 days, 76.8 percent during the first 3. An ecologically more meaningful estimate of assimilation efficiency was calculated by integrating the ^{14}C and ^{51}Cr counts over the 15 days that faeces were collected. The applications of this approach to measuring assimilation efficiency are wide. They include the possibility of measuring how much excreta are produced from a given amount of ingesta and of determining the role of gut-microorganisms in the assimilation of their host's food. (JWP)

15136 RADIOIMMUNOASSAY. Vecsei, P. (Heidelberg Univ. (F. R. Germany). Pharmakologisches Inst.). Prakt. Anaesthesie Wiederbeleb. Instensivtherapie.; 9: No. 5, 359-363(Oct 1974). (In German).

2 figs.; 1 tab.; 24 refs.

By means of the radioimmunoassay method, hormones, medicaments, and toxic, exogenic substances can be determined. The radioimmunoassay method is indispensable today in tumor diagnostics, immunochemistry, and in many other clinical fields. (DE)

15137 SERUM LEVEL AND URINARY EXCRETION OF ^{14}C-THIAMAZOL IN PATIENTS WITH HYPERTHYROIDISM. Balzer, J.; Lahrtz, H. (Kiel Univ. (F. R. Germany). 2. Medizinische Klinik und Poliklinik); van Zwieten, P. A. (Amsterdam Univ. (Netherlands). Lab. voor Biofarmacie). Dtsch. Med. Wochenschr.; 100: No. 11, 548-552(Mar 1975). (In German).

4 figs.; 2 tabs.; 7 refs.

2-(^{14}C) Thiamazol (Favistan) was administered intravenously in a therapeutically subthreshold dose to seven control subjects and five patients with hyperthyroidism. In both groups the reduction of plasma radioactivity occurred with at least two exponentials. Half-life was calculated to be 35 minutes for the faster and 28 hours for the slower process in the control group, and 12 minutes and about 20 hours, respectively, in the hyperthyroid patients. Forty-eight hour urinary excretion of the injected radioactive material was about 80% for the hyperthyroid patients and 87% for the control subjects. Maximal activity in urine occurred about six hours after injection. There was practically no demonstrable plasma-pro-

tein binding of the drug in in-vitro experiments. As the pharmacokinetics of the drug are not influenced in thyroid disease, there is apparently no need to adapt thyrostatic dosage in hyperthyroid states. (DE)

15138 INCORPORATION OF ORTHO-^{32}P-PHOSPHATE INTO PHOSPHATIDYLCHOLINES AND PHOSPHATIDYLETHANOLAMINES IN RAT SKELETAL MUSCLE. Shamgar, F. A.; Collins, F. R. (Univ., Melbourne). Biochim. Biophys. Acta; 409: No. 1, 104-115(21 Oct 1975).

The specific radioactivities of individual molecular species of muscle phosphatidylcholine and phosphatidylethanolamine have been measured by a combination of argentation thin-layer chromatography and countercurrent distribution. The specific radioactivities of individual molecular species of muscle phosphoglycerides have been determined 3h after intraperitoneal injection of ortho [^{32}P] phosphate. Under these conditions, the specific radioactivities of the species present in rat muscle were found to be measures of the relative turnover times of these molecules. The specific radioactivity of phosphatidylcholine was approximately three times that of phosphatidylethanolamine. The 1-palmitoyl-2-oleoyl and 1-oleoyl-2-linoleoyl phosphatidylcholines had the fastest turnover, and the 1-stearoyl-2-arachidonoyl the slowest. The results indicate that phosphoglycerides in muscle turn over more slowly and more evenly than do liver phosphoglycerides. (NL)

15139 STUDIES OF SULFATE UTILIZATION BY ALGAE. XIII. Adenosine 5'Phosphosulphate (APS) as an Intermediate in the Conversion of Adenosine 3'-Phosphare 5'Phosphosulphate (PAPS) to Acid-Volatile Radioactivity. Goldschmide, E. E.; Lik-Shing Tsang, M.; Schiff, J. A. (Brandeis Univ., Waltham, MA). Plant Sci. Lett.; 4: No. 5, 293-299(May 1975).

An intermediate, identified as adenosine 5'-phosphosulfate (APS), has been found in the enzymatic conversion of PAP^{35}S to acid-volatile radioactivity by enzyme fractions "A" and "S" from Chlorella pyrenoidosa. "A" was found to be a Mg^{2+}-dependent 3'-nucleotidase specific for 3'5'-diphosphonucleosides which converts adenosine 3'-phosphate 5'-phosphosulfate (PAPS) to APS. Authentic AP^{35}S is a substrate for "S" and yields acid-volatile radioactivity in the presence of Mg^{2+} and a thiol. This is of some interest since Chlorella is an assimilatory sulfate reducer and APS has been reported as a substrate only for dissimilatory sulfate reduction. PAPS production is undoubtedly concerned with providing a source of active sulfate for esterification reactions, but since fraction "A" can convert PAPS to APS, this may be yet another mechanism for forming APS despite the unfavorable equilibrium of the ATP sulfurylase reaction. (NL)

15140 INSTRUMENTATION IN NUCLEAR MEDICINE. Hoekstra, A. (State Univ., Utrecht). pp 1-10 of Nuclear Medicine. Ephraim, K. H.; Oei, H. Y. (eds.). Utrecht; Institute for Nuclear Medicine (24 Oct 1975).

From symposium on nuclear medicine; Utrecht, Netherlands (1975).

A review is given of instrumentation and methods currently in use in nuclear medicine. (NL)

15141 DEVELOPMENTS IN INFORMATION PROCESSING IN NUCLEAR MEDICINE. de Graff, C. N. (State Univ., Utrecht). pp 11-23 of Nuclear Medicine. Ephraim, K. H.; Oei, H. Y. (eds.). Utrecht; Institute for Nuclear Medicine (24 Oct 1975).

From symposium on nuclear medicine; Utrecht, Netherlands (1975).

Techniques for processing scintigraphic information that have recently become clinically applicable or that are promising for the future are described. Special attention is paid to in vivo analysis by means of digital computation. (NL)

15142 TOMOGRAPHIC SCINTIGRAPHY WITH A FRESNEL ZONE PLATE. van den Berg, C. J. M. (State Univ., Utrecht). pp 24-29 of Nuclear Medicine. Ephraim, K. H.; Oei, H. Y. (eds.). Utrecht; Institute for Nuclear Medicine (24 Oct 1975).

From symposium on nuclear medicine; Utrecht, Netherlands (1975).

15143 APPLICATION OF X-RAY FLUORESCENCE ANALYSIS IN MEDICINE. de Bruin, M.; Korthoven, P. J. M. (Interuniversitair Reactor Instituut, Delft, Netherlands). pp 30-39 of Nuclear Medicine. Ephraim, K. H.; Oei, H. Y. (eds.). Utrecht; Institute for Nuclear Medicine (24 Oct 1975).

From symposium on nuclear medicine; Utrecht, Netherlands (1975).

A review is given of the state of the art of X-ray fluorescence analysis as a tool in nuclear medicine, both for the quantitative measurement of elements and for scanning purposes. (NL)

15144 RADIONUCLIDES IN THE CLINICAL STUDY OF RENAL PHYSIOLOGY. Britton, K. E. (Middlesex Hospital, London). pp 40-53 of Nuclear Medicine. Ephraim, K. H.; Oei, H. Y. (eds.). Utrecht; Institute for Nuclear Medicine (24 Oct 1975).

From symposium on nuclear medicine; Utrecht, Netherlands (1975).

A view is presented of the use and misuse of some techniques using radionuclides in the measurement of total renal blood flow, the individual contribution of each kidney to total uptake function and the distribution of function between two populations of nephrons in each kidney. (NL)

15145 VALUE OF SEQUENTIAL IMAGES PERFORMED DURING RENOGRAPHY FOR THE RECOGNITION OF UNILATERAL KIDNEY DISEASE. Oei, H. Y.; Ephraim, K. H.; Nieuwenhuis, M. G. (State Univ., Utrecht). pp 54-59 of Nuclear Medicine. Ephraim, K. H.; Oei, H. Y. (eds.). Utrecht; Institute for Nuclear Medicine (24 Oct 1975).

From symposium on nuclear medicine; Utrecht, Netherlands (1975).

Sequential imaging during renography and its value for the recognition of unilateral kidney disease is discussed. The asymmetry of renal radiohippuran distribution is visually evaluated. The data suggest the absence of false negative interpretations. (NL)

15146 CLINICAL EXPERIENCE FROM RENOGRAPHY WITH ELECTRONICALLY ASSISTED KIDNEY LOCALIZATION. A Technique of Renography with Electronically Assisted Kidney Localization. Munck, O.; Mogensen, P.; Baerenholdt, O.; Jensen, H.; Lefevre, H.; Bay-Nielsen, H.; Egeblad, M.; Toennesen, K. H.; Wolf, H. (KAS Glostrup Hospital, Denmark). pp 61-73 of Nuclear Medicine. Ephraim, K. H.; Oei, H. Y. (eds.). Utrecht; Institute for Nuclear Medicine (24 Oct 1975).

From symposium on nuclear medicine; Utrecht, Netherlands (1975).

A description is given of a renography (RNG) technique employing a new electronic system for localization of the kidneys. Reference values and precision of the technique are given. On the basis of the data from 243 patients it is shown that RNG to a large extent can replace intravenous pyelography (IVP) in the control of patients treated surgically for carcinoma of the uterine cervix. From 80 comparisons of the results of IVP and RNG combined with an x-ray of the abdomen an examination protocol for patients with unilateral ureterolithiasis is put forward. From the results of pre- and postoperative measurements in 28 patients undergoing unilateral nephrectomy, preoperative renography and glomerular filtration rate (GFR) determination is recommended for the routine assessment of the residual kidney function. (NL)

15147 EVALUATION OF RENAL TRANSPLANT USING γ CAMERA AND COMPUTER ON-LINE. Oei, H. Y.; Ephraim, K. H.; Jessurun, R. F. M.; Nieuwenhuis, M. G. (State Univ., Utrecht). pp 74-87 of Nuclear Medicine. Ephraim, K. H.; Oei, H. Y. (eds.). Utrecht; Institute for Nuclear Medicine (24 Oct 1975).

From symposium on nuclear medicine; Utrecht, Netherlands (1975).

A non-invasive radionuclide procedure to study the kidney allotransplant is described. For this purpose a γ camera is used with a computer on-line. A quantitative method for studying the first and second phase of the renogram is discussed. The information from sequential images obtained during renography is presented. With this equipment the potency of renal vessels can easily be studied. (NL)

15148 RADIONUCLIDE ANGIOGRAPHY OF THE KIDNEYS. de Haas, G.; van Waes, P. F. G. M.; Ruys, J. H. J. (State Univ., Utrecht). pp 88-106 of Nuclear Medicine. Ephraim, K. H.; Oei, H. Y. (eds.). Utrecht; Institute for Nuclear Medicine (24 Oct 1975).

From symposium on nuclear medicine; Utrecht, Netherlands (1975).

15149 EARLY ADRENAL IMAGING USING SUBTRACTION TECHNIQUES. Britton, K. E. (Middlesex Hospital, London). pp 107-114 of Nuclear Medicine. Ephraim, K. H.; Oei, H. Y. (eds.). Utrecht; Institute for Nuclear Medicine (24 Oct 1975).

From symposium on nuclear medicine; Utrecht, Netherlands (1975).

A technique is described for efficient imaging of the adrenal glands on the 3rd day after intravenous injection of ^{131}I-iodocholesterol. Computer assisted subtraction of a simultaneously recorded liver, spleen, and two kidneys image overcomes the problem of high activity in the adrenal environment. This technique has enabled visualization of some adrenal adenoma at 2

hours and this opens the way to the synthesis and use of ^{123}I-iodocholesterol derivatives. Clinical experience in patients with Conn's and Cushing's syndrome is summarized. (NL)

15150 USE OF RADIONUCLIDES IN STUDIES ON PRODUCTION RATES AND METABOLISM OF STEROID HORMONES. Thijssen, J. H. H. (State Univ., Utrecht). pp 115-125 of Nuclear Medicine. Ephraim, K. H.; Oei, H. Y. (eds.). Utrecht; Institute for Nuclear Medicine (24 Oct 1975).

From symposium on nuclear medicine; Utrecht, Netherlands (1975).

The blood production rate of androstenedione, its conversion to estrone and the resulting production rate of estrone were determined in a group of normal postmenopausal women and in a group of women with primary breast cancer. The production rates were measured with a technique in which tritiated estrone and ^{14}C-androstenedione were infused while blood and urine samples were measured regularly. (NL)

15151 QUANTITATIVE ASPECTS OF SERUM ANTI-DNA MEASUREMENTS. Holian, J. (Radiochemical Centre Ltd., Amersham, Eng.); Griffiths, I. D.; Glass, D. N.; Maini, R. N.; Scott, J. T. pp 126-137 of Nuclear Medicine. Ephraim, K. H.; Oei, H. Y. (eds.). Utrecht; Institute for Nuclear Medicine (24 Oct 1975).

From symposium on nuclear medicine; Utrecht, Netherlands (1975).

A new method is described for the measurement of serum antibodies to native DNA. A standardized technique is introduced that relies on the use of standard reference sera in each assay to give a consistent and linear scale of anti-DNA concentration. The anti-DNA measurements may be made with high precision and there is good correlation of results between different laboratories. The results confirm the high specificity of circulating anti-DNA antibodies for systemic lupus erythematosus and the correlation of the anti-DNA level with disease activity. (NL)

15152 FOCUSSING OF SCINTIGRAMS USING A DECONVOLUTION FILTER BASED ON FRIDMAN'S THEOREM. van de Berg, C. J. M.; de Graaf, C. N.; van Rijk, P. P.; Jambroes, G. (State Univ., Utrecht). pp 138-142 of Nuclear Medicine. Ephraim, K. H.; Oei, H. Y. (eds.). Utrecht; Institute for Nuclear Medicine (24 Oct 1975).

From symposium on nuclear medicine; Utrecht, Netherlands (1975).

15153 SCINTIGRAPHY OF THE HEART USING THALLIUM-201 AND ITS CLINICAL IMPLICATIONS. Jambroes, G.; van Rijk, P. P.; de Graaf, C. N.; van de Berg, C. J. M. (State Univ., Utrecht). pp 143-150 of Nuclear Medicine. Ephraim, K. H.; Oei, H. Y. (eds.). Utrecht; Institute for Nuclear Medicine (24 Oct 1975).

From symposium on nuclear medicine; Utrecht, Netherlands (1975).

Primary results are presented of myocardial scintigraphy using thallium-201. It is shown that myocardial infarction can be traced with this method in recent infarctions as well in healed myocardial injury. Ischaemic areas in the myocardium cannot be distinguished from infarction if occurring at rest. Ischaemia at exercise however is demonstrable if ischaemic ST-T changes occur. (NL)

15154 RELIABILITY OF MYOCARDIAL SCINTIGRAPHY WITH THALLIUM-201. A Comparison Between Radiocardiography and Between Perfusion Scintigraphy. Winkler, C.; Felix, R.; Pensky, W.; Wagner, J.; Simon, H. (Univ., Bonn). pp 151-152 of Nuclear Medicine. Ephraim, K. H.; Oei, H. Y. (eds.). Utrecht. Institute for Nuclear Medicine (24 Oct 1975).

From symposium on nuclear medicine; Utrecht, Netherlands (1975).

15155 TRANSMISSION AND EMISSION SCINTIGRAPHY IN PATIENTS WITH PERICARDIAL EFFUSIONS. de Haas, G. (State Univ., Utrecht). pp 153-161 of Nuclear Medicine. Ephraim, K. H.; Oei, H. Y. (eds.). Utrecht; Institut for Nuclear Medicine (24 Oct 1975).

From symposium on nuclear medicine; Utrecht, Netherlands (1975).

A simple non-invasive method to determine the presence of a pericardial effusion is described. The equipment includes an Auger-type scintillation camera, a closed TV-circuit, and a videorecorder. Transmission scintigraphy and emission scintigraphy with technetium-99m pertechnetate are used in combination. A U-shaped clear zone around the heart at ten to fifteen minutes after injection and still persisting at twenty minutes, is a reliable sign of a pericardial effusion. (NL)

15156 QUANTITATIVE ANALYSIS OF LEFT-TO-RIGHT SHUNTS USING DECONVOLUTION AND GAMMA FUNCTION VARIATE FITTING. van Rijk, P. P.; de Graaf, C. N. (State Univ., Utrecht). pp 162-174 of Nuclear Medicine. Ephraim, K. H.; Oei, H. Y. (eds.). Utrecht; Institute for Nuclear Medicine (24 Oct 1975).

From symposium on nuclear medicine; Utrecht, Netherlands (1975).

A non-invasive method is described, for the detection of left-to-right shunts using gamma camera imaging of radioisotope trace dilution, aided by computer reconstruction of the pulmonary impulse response, applying a deconvolution process and quantitative analysis of the shunt by least squares gamma function variate fitting of the deconvolved pulmonary curve and early recirculation contribution, which in combination with a low absorbed radiation dose and — compared to other methods — reduced inconvenience for the patient, gives us a clinically useful screening method. (NL)

15157 CARDIAC DYNAMICS USING THE COMPUTERIZED MULTICRYSTAL GAMMA CAMERA. Fischer, D. S. (Baird Atomic (Europa) B. V., The Hague); Schad, N. pp 175-182 of Nuclear Medicine. Ephraim, K. H.; Oei, H. Y. (eds.). Utrecht; Institute for Nuclear Medicine (24 Oct 1975).

From symposium on nuclear medicine; Utrecht, Netherlands (1975).

A description is given of performance characteristics of a high counting rate gamma camera system. Clinical applications, e.g., the investigation of cardiac dynamics are described. (NL)

15158 RADIONUCLIDE VENOGRAPHY IN VENOUS DISEASES. van Rijk-Zwikker, G. L. (Sint Antonius Ziekenhuis, Utrecht); van Rijk, P. P. pp 183-195 of Nuclear Medicine. Ephraim, K. H.; Oei, H. Y. (eds.). Utrecht; Institute for Nuclear Medicine (24 Oct 1975).

From symposium on nuclear medicine; Utrecht, Netherlands (1975).

Radionuclide venography was performed in 195 patients to evaluate its usefulness in various venous diseases. It proved to provide very good information about upper leg and pelvic vein thrombosis, while peripheral thrombi were also detected. From the flowpattern additional knowledge was obtained on the status of the deep venous system in patients with primary and secondary varicosis and venous leg ulcers. (auth)

15159 CLINICAL VALUE OF ABDOMINAL LYMPHNODE SCINTIGRAPHY. Cox, P. H. (Rotterdams Radio Therapeutisch Instituut). pp 196-203 of Nuclear Medicine. Ephraim, K. H.; Oei, H. Y. (eds.). Utrecht; Institute for Nuclear Medicine (24 Oct 1975).

From symposium on nuclear medicine; Utrecht, Netherlands (1975).

Particulate radiocolloids injected subcutaneously into the lower limbs, usually into the dorsum of the foot, are transported via the lymphatics. Activity is partially retained in the retroperitoneal lymphnodes before passing through the thoracic duct, after which it accumulates in the RES primarily in the liver. Scintigrams prepared with the aid of a gammacamera provide not only an anatomical localization of nodes, but yield information concerning their physiological state and delineates the route of lymph drainage. Primary lymphnode malignancy can be distinguished from metastatic disease and disturbances in lymph drainage can be localized. Using 197 Mercuric sulphide colloid a good degree of correlation has been obtained with radiocontrast lymphangiography and the technique has proved to have a number of advantages over the latter. (NL)

15160 COPPER METABOLISM, PARTICULARLY IN RELATION TO WILSON'S AND MENKES' DISEASES. van den Hamer, C. J. A. (Interuniversitair Reactor Instituut, Delft, Netherlands); Willemse, J.; de Haas, G. pp 204-216 of Nuclear Medicine. Ephraim, K. H.; Oei, H. Y. (eds.). Utrecht; Institute for Nuclear Medicine (24 Oct 1975).

From symposium on nuclear medicine; Utrecht, Netherlands (1975).

A brief description is given of normal copper metabolism in man. Results obtained with the copper-64 loading test which can differentiate between normals and patients with Wilson's and Menkes' disease are given. (NL)

15161 LABELLED OROSOMUCOID AS A PHARMACON FOR DYNAMIC LIVER STUDIES. van Rijk, P. P. (State Univ., Utrecht); van den Hamer, C. J. A. pp 217-228 of Nuclear Medicine. Ephraim, K. H.; Oei, H. Y. (eds.). Utrecht; Institute for Nuclear Medicine (24 Oct 1975).

From symposium on nuclear medicine; Utrecht, Netherlands (1975).

15162 LABELLED BLEOMYCIN AS A RADIOPHARMACEUTICAL, PREPARATION AND QUALITY CONTROL. Pieters, H. J. L. M.; Oldenburg, S. J.; Vree. P. H. (State Univ., Utrecht).

pp 229-239 of Nuclear Medicine. Ephraim, K. H.; Oei, H. Y. (eds.). Utrecht; Institute for Nuclear Medicine (24 Oct 1975).

From symposium on nuclear medicine; Utrecht, Netherlands (1975).

A study on the various preparation procedures and methods of sterilization of indium-111 bleomycine was performed with regard to temperature, pH, and concentration. The influence of transferrin in vitro and in vivo in rats, on the complex and its relation to the blood clearance was investigated. Indium-111 bleomycine may become a useful tumor-scanning radiopharmaceutical. (NL)

15163 EARLY DIAGNOSIS AND STAGE DETERMINATION OF BRONCHIAL CARCINOMAS USING RADIOSPIROMETRIC METHODS. Roesler, H. (Univ., Bern). pp 240-252 of Nuclear Medicine. Ephraim, K. H.; Oei, H. Y. (eds.). Utrecht; Institute for Nuclear Medicine (24 Oct 1975).

From symposium on nuclear medicine; Utrecht, Netherlands (1975).

Radiospirometry using xenon-133 and the scintillation camera can differentiate between vascular, parenchymal or reflexive origins of a defect seen in the perfusion scintigram. The bronchial carcinoma, depending on its stage, causes different ventilation and perfusion disturbances which can be classified according to their localization and their pathological-anatomic changes. (NL)

15164 RHYTHMIC INCORPORATION OF ^{3}H LEUCINE IN HUMAN PERIPHERAL LEUKOCYTES. Sobel, J. S.; Halbrecht, I.; Modan, M. (Tel Aviv Univ., Israel). J. Interdiscip. Cycle Res.; 6: No. 3, 241-248(Sep 1975).

Cultured lymphocytes showed an oscillatory pattern of 3H leucine incorporation into TCA precipitable material when labelled in sequential 2-hr pulses for 26 hrs. Leukocytes obtained from successive bleeding samples in 4-hr intervals exhibited a similar pattern of 3H leucine incorporation. Statistical analysis showed the oscillatory incorporation pattern to be significant and not the result of random fluctuations. The cycle length was approximately 6 hrs. (NL)

15165 DYNAMIC LUNG TRANSMISSION STUDIES. Mattart, A. V. J.; Molkenboer, J.; de Graaf, C. N.; Ephraim, K. H. (State Univ., Utrecht). pp 253-260 of Nuclear Medicine. Ephraim, K. H.; Oei, H. Y. (eds.). Utrecht; Institute for Nuclear Medicine (24 Oct 1975).

From symposium on nuclear medicine; Utrecht, Netherlands (24 Oct 1975).

15166 CORRELATION OF RADIAL BONE MINERAL CONTENT WITH TOTAL BODY CALCIUM IN CHRONIC RENAL FAILURE. Cohn, S. H.; Ellis, K. J.; Caselnova, R. C.; Asad, S. N.; Letteri, J. M. (Brookhaven National Lab., Upton, NY). J. Lab. Clin. Med.; 86: No. 6, 910-919(Dec 1975).

Loss of bone mineral of the skeleton in renal disease can be measured directly by total body neutron activation analysis (TBNAA), and also by an absorptiometric technique applied to the appendicular skeleton (radius). In the present study the results of these two techniques are compared in 25 patients with renal insufficiency, 53 patients with end-stage renal failure on dialysis, and 24 normal control subjects. It is apparent that there is good correlation between total body calcium (TBCa) and bone mineral content (BMC) in all groups studied. The correlation in the normal contrast group was 0.944 as compared to 0.919 for the renal patients and 0.892 for patients with end-stage renal failure on dialysis. In order to measure the relative deficit in TBCa in individual patients from the absolute Ca measurement, it is necessary to normalize the data for sex, age, and skeletal size. For this purpose, an empirically derived relationship was used to predict the normal skeletal Ca in each subject, based on weight, height, sex, and age. The measured TBCa divided by the predicted TBCa is referred to as the calcium ratio. This ratio is useful in expressing the relative deficit of Ca in individual renal patients. In similar manner, BMC data were normalized, with the same relationship used to obtain BMC ratios. The normalization procedures allow both the TBCa and BMC measurements to be used to quantitate the Ca deficit in individual patients with renal insufficiency. (auth)

MATERIALS

15167 (CEA-R-4703) CORRELATION EFFECTS IN DIFFUSION: A NEW APPROACH. Benoist, P.; Bocquet, J. L.; Lafore, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91- Gif-sur-Yvette (France). Div. de Metallurgie et d'Etude des Combustibles Nucleaires). Nov 1975. 37p. (In French). Dep. NTIS (US Sales Only) $5.00.

All the methods used up to now to solve the correlation problems are approximate. They indeed don't allow the defect causing the migration to walk to infinity in the crystal. A new method is described which can be used to solve rigorously the correlation problems with the use of double Laplace–Fourier transforms. The method yields both: a compact formulation of all the problems previously treated by other investigators; a solution for problems still unresolved (influence of vacancy concentration on the correlation factor for self diffusion) or too sophisticated to be treated by the previous methods (dissociated interstitial...). (auth)

15168 CHEMICAL VAPOR DEPOSITION. Fifth International Conference Held at Buckinghamshire, England, September 21–26, 1975. Blocher, J. M. Jr.; Hintermann, H. E.; Hall, L. H. (eds.). Princeton, NJ; The Electrochemical Society, Inc. (1975). 848p. (CONF-750991-).

59 papers and 9 abstracts are arranged under the headings: fundamentals, unusual CVD processes, hybrid processes, single-crystal growth, electronic applications, hard coatings, fibers and composites, energy conversion applications, and miscellaneous coatings. Author and keyword indexes are included at the end. Separate abstracts were prepared for 25 papers; two others were processed for EDB. (DLC)

For abstracts of individual papers see: 15211–15220, 15232, 15248–15257, and 15359–15362.

Ceramics and Cermets

Refer also to abstracts 15233, 15247, 15252, 15297, 15302, 15305, 15315, 15317, 15333, 15350, 16114, 16291, 16294, 16519, and 16530.

15169 (AE-507) X-RAY CHARACTERIZATION OF NON-EQUILIBRIUM SOLID SOLUTIONS. Brown, A.; Rosdahl, O. (Aktiebolaget Atomenergi, Studsvik (Sweden)). 1975. 29p. Dep. NTIS (US Sales Only) $5.00.

The Rudman approach to composition line broadening in x-ray diffraction patterns, originally designed for the study of diffusion in alloys, is seen to provide a basis for characterizing inhomogeneous solid solutions. Limitations, imposed on this treatment when the cell dimensions of the primary components differ by less than 0.1 Å, are attributable to experimental effects such as instrument broadening. These limitations can be overcome by a rigorous numerical treatment of the measured data. Thus, separate elimination of the $K\alpha_2$ radiation component followed by iterative deconvolution are advocated for the recovery of the intrinsic broadening. This course of action is made possible chiefly through the availability of large, fast memory computers and primary data recorded in the form of a step scan on punched paper tape. The characteristics of inhomogeneous solid solutions made available by the above treatment are the identity of closely similar, solid solution phases, the frequency distribution curve for a chosen component, and the degree of homogeneity of the x-ray sample. (auth

15170 (BNL-20600) SPIN-WAVE AND CRITICAL SCATTERING OF NEUTRONS FROM COBALT DISULFIDE. Iizumi, M.; Lynn, J. W.; Ohsawa, A.; Ito, H. (Brookhaven National Lab., Dep. NTIS $4.50.

From 21st annual conference on magnetism and magnetic materials; Philadelphia, Pennsylvania, USA (9 Dec 1975).

The triple-axis neutron scattering technique has been used to measure the temperature dependence of the spin-wave and critical scattering below T/sub c/(equals 120°K) in the metallic ferromagnet CoS_2. The spin-wave dispersion relations at small propagation vectors (parallel q parallel less than or equal to 0.3 A^{-1}) can be described by ħ omega equals Dq^2- Eq^4 with D of about 110 MeV-A^2 and E/D of 1 approximately 2A^2 at 78°K, with a small anisotropy observed in the different symmetry directions of the crystal. At small q, D is found to renormalize as (1-T/T/sub c/)/sup beta/ with beta equals 0.24. Some indication of a triple-peaked structure in the scattering spectrum was observed immediately below T /sub c/. (auth)

15171 (CEA-R-4699) X RAY TOPOGRAPHIC STUDY OF DEFECTS AND MAGNETIC DOMAINS IN RARE EARTH IRON GARNETS. Mathiot, A. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). 9 Jun 1975. 170p. (In French). Dep. NTIS (US Sales Only) $7.75.

Thesis.

X ray topographs allow simultaneous observations of most crystalline defects and magnetic domain walls. The easy magnetization directions of rare earth iron garnets are (111) and the equilibrium texture of (110) slices is limited by a rectangular array of 71° and 109° walls. Since the anisotropy and magnetostriction of the chosen compounds (TbIG and DyIG) increase sharply when the temperature is lowered, the influence of these parameters has been studied between 300 and 4.2°K. Because of the increase of spontaneous magnetization and anisotropy, the domain number increases at low temperatures and the texture becomes less sensitive to the crystal imperfections. Besides the 109° walls disappear almost completely from the pattern; this has been shown to be due to the respective values of the wall energies, and particularly to the influence of the K_2 anisotropy constant. The contrasts observed on the topographs also increase sharply because of the high values of the λ_{111} coefficient of spontaneous magnetostriction at low temperatures. A splitting of the Bragg reflection peak into two, below 60°K for TbIG, each part corresponding to one family of domains, allowed a direct measurement of λ_{111}. The garnets are choice materials to study domain walls because of the large range of the anisotropy and magnetostriction values obtained in those compounds. (auth)

15172 (CERN-75-16) EFFECTS OF NUCLEAR RADIATION ON THE OPTICAL PROPERTIES OF CERIUM-DOPED GLASS. McGrath, B.; Schoenbacher, H.; Van de Voorde, M. (European Organization for Nuclear Research, Geneva (Switzerland)). 20 Nov 1975. 11p. Dep. NTIS (US Sales Only) $4.50.

Twenty types of glass containing 0.5 to 4% CeO_2 have been irradiated in a ^{60}Co γ cell and in the mixed neutron–γ field of a nuclear reactor, at total integrated doses of up to 5×10^9 rad (CH). The resulting coloration has been assessed quantitatively by measuring the light transmission with reference to air, in the range 360 to 510 nm. From the results, certain types of glass suitable for applications in nuclear engineering can be selected. Specifically, it was found that 1 to 2% CeO_2 content is usually sufficient to obtain radiation-resistant optical glass: the reduction in light transmission above 450 nm is nil at 10^8 rad (CH), below 10% at 10^9 rad (CH), and below 20% at 5×10^9 rad (CH); the post-irradiation fading is negligible. (auth)

15173 (CNLM-3871) REACTOR PROGRAM DESCRIPTION OF TASKS FOR PERIOD MAY 1, 1961–JUNE 30, 1965. (Pratt and Whitney Aircraft, Middletown, Conn. (USA)). 1965. Contract AT(30-1)-2789. 195p. Dep. NTIS $7.50.

Research activities devoted to development of compact Li-cooled reactors are summarized. Research results are presented in sections on reactor experiment design, reactor development, reactor shield development, primary system development, secondary system development, auxiliary systems development, control system development, instrument development, materials development, physics development, fuel material irradiation for PWAR-16, component irradiation, operation evaluation, reactor test facility design, test facility construction, fuel element fabrication, reactor fabrication, shield fabrication, primary and secondary coolant system for PWAR-16, auxiliary systems fabrication, operation of PWAR-16 and component fabrication for PWAR-18. (JRD)

15174 (COO-1140-217) HIGH TEMPERATURE CHEMISTRY. Progress Report, 1 November 1974-31 October 1975. Gilles, P. W. (Kansas Univ., Lawrence (USA). Dept. of Chemistry). 31 Oct 1975. Contract E(11-1)-1140. 17p. Dep. NTIS $3.50.

Activities are described under the topics of education, publications and talks, research progress highlights, space and facilities, level of activity, and miscellaneous. Current research is reported for the high temperature thermodynamics and vaporization of the titanium oxides, the vaporization of the rare-earth borides, the phase studies on the Zr-Nb-O system, the studies on high-molecular weight inorganic species, and the kinetic studies on high-temperature vaporization processes. (auth)

15175 (INIS-mf-1769, pp 107-118) COMPUTER-AIDED INVESTIGATION OF SINTERING KINETICS OF URANIUM DIOXIDE. Pejovnik, S.; Susnik, D.; Kolar, D. Sep 1974.

From 4th international conference on powder metallurgy; Strbske Pleso, Czechoslovakia (1 Oct 1974).

In powder metallurgy 74. I. Conference proceedings.

Phenomenological equations of sintering proposed by Ivensen for metallic powders and by Tikannen for powders in general

were used to interpret the data on the sintering of oxide materials, particularly UO_2. The equation parameters were calculated by a computer. It is demonstrated that the program chosen made it also possible to obtain the parameters of several other sintering equations. An analysis of the results is given. (auth)

15176 (IS-RIC-5) THERMOCHEMISTRY OF THE RARE EARTH CARBIDES, NITRIDES, AND SULFIDES FOR STEELMAKING. Gschneider, K. A. Jr.; Kippenhan, N. (Iowa State Univ. of Science and Technology, Ames (USA). Rare-Earth Information Center). Aug 1971. 27p. Ames Lab., IA.

For Molybdenum Corporation of America, New York, NY.

Standard heats and free energies of formation were calculated at 298 and 400 to 2500°K for LaC_2, CeC_2, PrC_2, NdC_2, SmC_2, GdC_2, several R_2C_3 compounds, LaN, CeN, YN, LaS, CeS, PrS, GdS, YS, and several R_3S_4 and R_2S_3 compounds. For comparison, the free energies of formation of these compounds were plotted over 77 to 5000°F with these of non-rare earth compounds. 65 references, 17 tables (DLC)

15177 (LA-6037-MS) REVIEW OF THERMAL EXPANSION AND DENSITY OF URANIUM AND PLUTONIUM CARBIDES. Andrew, J. F.; Latimer, T. W. (Los Alamos Scientific Lab., N. Mex. (USA)). Jul 1975. Contract W-7405-Eng-36. 17p. Dep. NTIS $4.00.

The published literature on linear thermal expansion and density of uranium and plutonium carbide nuclear fuels, including UC, PuC, (U,Pu)C, U_2C_3, Pu_2C_3, and $(U,Pu)_2C_3$, is critically reviewed. Recommended values are given in tabular form and additional experimental studies needed for completeness are outlined. 16 tables, 52 references. (auth)

15178 (ORNL-5051) HOT-PRESSING STUDY ON MIXED URANIUM–PLUTONIUM NITRIDE FOR ADVANCED REACTOR FUEL. Chang, J. Y. (Oak Ridge National Lab., Tenn. (USA)). Nov 1975. Contract W-7405-eng-26. 66p. Dep. NTIS $5.50.

The hot-pressing characteristics of mixed (U,Pu)N for advanced reactor fuel were studied in order to provide a better insight into the densification process and thus improve fuel fabrication technique. A detailed experimental procedure for continuous measurement of densification and an analog computer circuit to simulate hot-pressing are presented. Mixed (U,Pu)N of 99 percent density was fabricated at 4000 psi and 1450°C, and 94 percent density was obtained with 3000 psi at 1450°C. A digital computer program for the densification process was also written to analyze and predict the density of the pellet at any given time or at different applied pressures than those actually tested. The time dependence of the temperature in the proposed equation to simulate the experimental heating period of the die was first introduced to improve the interpretation of experimental data. The best values of the hot-pressing coefficients were determined by curve fiting of the equation with experimental data. The values are given for mixed (U, Pu)N that had been fabricated with a starting density of 63 percent and a hot-pressing pressure of 3000 psi at 1450 +- 10°C. (auth)

15179 (SAND-75-0338) DETERMINATION OF ELECTRO-MAGNETIC ABSORPTION PARAMETERS BY REFLECTION MEASUREMENTS. Vittitoe, C. N. (Sandia Labs., Albuquerque, N. Mex. (USA)). Sep 1975. Contract AT(29-1)-789. 44p. Dep. NTIS $4.00.

The method described is for determining the electromagnetic absorption parameters of a material by measuring the optical reflection from a thick sample. With linearly polarized incident light (both perpendicular to and parallel to the plane of incidence), the ratio of the reflected intensities at three or more angles of incidence offers promise for determining the complex index of refraction of a material for a broad range of parameter values. The method may be applicable to molten materials, such as UO_2, where high temperatures cause corrosion and containment difficulties. A method is given for extending the data to neighboring frequencies. Use of the method was successful for all portions of the complex index of refraction plane except for small values of the extinction coefficient. (auth)

15180 CORROSION FATIGUE OF STEELS IN GEOTHERMAL STEAM. Okazaki, S.; Nakamura, H. Zairyo; 24: No. 256, 15-21 (Jan 1975). (In Japanese).

The corrosion fatigue of 13Cr–Mo, 12Cr–Mo–V, 3Cr–Mo, Cr–Mo–V, and 3. 7Ni–Cr–Mo steels in geothermal steam containing H_2S was investigated. The fatigue strength of the steels was, in general, much lower than in air. A method of estimating fatigue strength at ~10^9–10^{12} cycles in geothermal steam from the corrosion–fatigue strength of the specimen and the fatigue strength of the corroded specimen was established by separating the cycle-dependent from the time-dependent effect of corrosion damage. (Metals Abstr.)

15181 ACTINIDE REDISTRIBUTION DUE TO PORE MIGRATION IN HYPOSTOICHIOMETRIC MIXED-OXIDE FUEL PINS. Guarro, S.; Olander, D. R. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). J. Nucl. Mater.; 57: No. 2, 136-144(Aug 1975).

Redistribution of plutonium due to migration of pores in hypostoichiometric mixed-oxide fuel is analyzed. The unequal volatilities of the oxides of uranium and plutonium cause changes in the Pu/U ratio in the solid ahead of and in the wake of a moving pore. These elementary redistribution events of single pores are then combined to determine the gross redistribution in the fuel. For typical LMFBR fuel operating conditions, calculated redistribution due to pore migration is orders of magnitude smaller than that observed in irradiated pins. (NL)

15182 WEAR TEST RESULTS OF CARBIDE DIES TREATED WITH IMPLIFE: A THERMO-CHEMICAL DIFFUSION PROCESS. Linial, A. V.; Sidell, H. Wire, J.; 8: No. 3, 63-66(Mar 1975).

The newly developed boronizing process, known as Implife process, improves die performance, especially the surface. By diffusion the process introduces B into the surface of the carbide to a depth of approximately 0.0002 to 0.0007 in. depending upon requirements. The relatively soft Co binder is changed to cobalt diboride, and the tungsten carbide is changed to another crystallographic structure. Hardness data are plotted to illustrate the effect of B on surface hardness. The process does not produce dimensional change. Test results have shown that die life has been increased an average of 58 percent. It was considered that the lower coefficient of friction with the coating eliminates effects of porosity inherent in the finish of some carbide dies. Boronizing does not end with its use on wire dies. Applications exist in drawing equipment such as bands on side drums, blocks and sheaves. An attempt is also being made to incorporate boronizing into cold heating tools. (Metals Abstr.)

15183 CARBOLOY GRADE (SINTERED CEMENTED CARBIDE). Alloy Dig.; vp(May 1974).

Carboloy Grade 370 containing 72.0 WC, 8.0 TiC, 11.5 TaC, 8.5 Co is a tough, wear-resistant grade of cemented carbide for heavy duty roughing cuts of steels, ferrous castings, stainless steels, and some high-temperature alloys. It successfully withstands those high temperatures encountered in heavy duty machining. It is used in the as-sintered condition, without further heat treatment. It cannot be machined, but can be ground to final size by use of SiC and diamonds as abrasives. Carbology 370 is rarely applied where corrosive environments exist. Safety note is given to ensure protection for personnel and equipment from flying fragments and sharp edges when working with these materials, and an adequate ventilation in grinding operation to avoid pulmonary problems. Microstructure and hardness vs. temperature curves for Carbology 370 are presented and its physical and mechanical properties are tabulated. (Metals Abstr.)

15184 EVIDENCE FOR ORDER–DISORDER IN PuC/sub 0.80/ AT LOW TEMPERATURES THROUGH SPECIFIC-HEAT MEASUREMENTS. Sandenaw, T. A. (Los Alamos Scientific Lab., N. Mex. (USA)). J. Nucl. Mater.; 57: No. 2, 145-150(Aug 1975).

Extreme dips, which are seldom reproducible, occur in specific heat versus temperature curves of PuC/sub 0.80/. Heat evolution, which appears to be the source of the dips, occurs in several strongly pronounced stages. This can be interpreted as evidence for both an antiphase-ordered structure and a martensite-like behavior. Attention is called to microscopy results for another nonstoichiometric NaCl-type carbide, having essentially the same metal atom/carbon atom ratio, where a faulted structure, crystallographic shear, and interstitial ordering of carbon voids are shown to exist. It is suggested that there is a preference for an ordered accommodation of excess vacancies (carbon voids) in PuC/sub 0.80/ into a long period superlattice as has been shown to occur with V_8C_5(VC/sub 0.83/). It is also speculated that this form of structural accommodation, which is similar to "crystallographic shear", is the source of a specific-heat behavior, which is equivalent to that of a quenched martensite. (NL)

15185 HYPERSTOICHIOMETRIC REGIONS AS POTENTIAL SHORT-CIRCUIT PATHS FOR OXYGEN DIFFUSION IN THE UNRESTRUCTURED REGIONS OF IRRADIATED UO_2 AND $(U,Pu)O_2$ NUCLEAR FUEL ELEMENTS. Brandt, W. W. (Wisconsin Univ., Milwaukee (USA). Dept. of Chemistry); Seils, C. A.; Johnson, C. E. (Argonne National Lab., Ill. (USA)). J. Nucl. Mater.; 57: No. 2, 212-220(Aug 1975).

The relative concentrations of oxygen in the unrestructured regions of several irradiated fuel elements of the composition (U,Pu)O/sub 2-x/ have been measured by electron microprobe methods. Fluctuations were found between closely spaced points, which indicate that hyperstoichiometric diffusion paths may well be formed and may greatly facilitate oxygen transport from the

interior to the edge of the elements. In some cases, average expected radial oxygen gradients were computed for the unrestructured regions, using literature data. The results indicate that a very small excess of oxygen, above the stoichiometric amount, is sufficient to account for the observed transport. (NL)

15186 TERNARY COMPLEX BORIDES WITH ThMoB4-TYPE STRUCTURE. Rogl, P.; Nowotny, H. Monatsh. Chem.; 105: No. 5, 1082-1098(1974). (In German)

Ternary complex borides of formula $MM'B_4$ (where M and M' are transition metals) were prepared within the systems Th–(V,Mo,W,Re)–B. The crystal structure of these compounds was determined by means of single-crystal photographs of the compounds $ThMoB_4$ and $ThWB_4$. $ThVB_4$, $ThMoB_4$, $ThWB_4$, and $ThReB_4$ were isotypic. The relationship to the crystal chemistry of boron layer structures such as AlB_2, $YCrB_4$, and Y_2ReB_6 is discussed. (Metals Abstr.)

15187 ON MASS TRANSPORT IN NUCLEAR CARBIDES BY EVAPORATION-CONDENSATION. Matzke, H. (Commission of the European Communities, Karlsruhe (F. R. Germany). European Inst. for Transuranium Elements). J. Nucl. Mater.; 57: No. 2, 180-186(Aug 1975).

Self-diffusion studies in the U-C system show a mass transfer between diffusion specimens. This phenomenon is shown to be due to rate-controlling metal-atom transport through the gas phase by evaporation-condensation, and fast carbon transport through solid-state diffusion. The activation energy of the process being about 5.0 eV is thus in agreement with literature data on the heat of vaporization of U from UC. The mass transfer can be measured very accurately and vapor pressures can be deduced. The same mechanism can also explain the observed pore mobilities in nuclear carbide fuels. (NL)

15188 DIFFRACTION STUDY OF αU_2N_{3+x}. Masaki, N.; Tagawa, H. (Japan Atomic Energy Research Institute, Tokai-mura, Naka-gun, Ibaraki-ken, Japan). J. Nucl. Mater.; 57: No. 2, 187-192(Aug 1975).

X-ray and neutron powder diffraction studies were made on nonstoichiometric αU_2N_{3+x} within the composition range $0.20 \leq x \leq 0.52$. It was found that in the region $0.20 \leq x \leq 0.48$ the compounds had a cubic symmetry whose structure was essentially bixbyite-type $U_2N_{3.52}$, however, had a rhombohedral symmetry [$a' = (6.50 \pm 0.3)$A, $\alpha = (99.7 \pm 0.6)^0$], while its structure was very similar to a fluorite-type one. The results show that the phase relation in the U_2N_3–UN_2 system is not a simple extension of that in the cubic cell, but analogous to that of some lanthanide oxide systems. (NL)

15189 REPLY TO MURCH'S "COMMENTS ON THE MECHANISM OF SELF-DIFFUSION OF CARBON IN HYPERSTOICHIOMETRIC URANIUM CARBIDE". Sarian, S. (Washington Univ., Seattle (USA)). J. Nucl. Mater.; 57: No. 2, 237-238(Aug 1975).

The correction to the D* term proposed by Murch seems important in several additional ways. First, assuming that the activation energy, ΔH_m, is essentially independent of the carbon-to-uranium ratio, it can be seen that the quantity $[(2-x)(x-1)]$ requires that the carbon diffusivity in hyperstoichiometric uranium carbides reach a maximum value at $x = 1.5$. Second, inclusion of the factor $(x-1)$ in the preexponential term also helps to explain the low experimental D* values commonly observed for slightly hyperstoichiometric compositions. (NL)

15190 CALCULATION OF THE CORRELATION FACTOR FOR A CARBON-DIFFUSION MECHANISM IN HYPERSTOICHIOMETRIC URANIUM CARBIDE. Murch, G. E. (Flinders Univ. of South Australia, Bedford Park. School of Physical Sciences). J. Nucl. Mater.; 57: No. 2, 239-242(Aug 1975).

Recently, Sarian described a model for the analysis of carbon-diffusion data in UC_x. For $x > 1$ he assumed that the mechanism of carbon diffusion is by way of single carbon atoms migrating from doubly occupied sites to singly occupied sites. This model was later discussed by the present author in terms of the dependence of the diffusion coefficient on composition. In that note it was assumed that the functional dependence of the tracer diffusion coefficient, D*, on composition could be represented entirely by the product of the defect concentration and the path probability. It was noted, however, that the tracer correlation factor and the entropy of migration also vary with composition, but the effect of such variations was not assessed. The purpose of the present note is to present results of a calculation of the correlation factor, using a diffusion simulation procedure. (NL)

15191 INTERACTION OF PULSED COHERENT LIGHT BEAMS WITH COMPLEX TARGETS. Application to the Fabrication of Thin Films Compounds. Desserre, J. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Metallurgie); Eloy, J. F. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Service de Chimie Analytique). Bull. Inf. Sci. Tech. (Paris); No. 204, 71-79(Jun 1975). (In French)

The interaction of light laser beam pulses produced by a solid state laser (Q switched or normally pulsed) with different targets (Ni_3Mn, CdTe, ZrC, $ReBe_{22}$) is used to realize their dynamic vaporization. Thin films with same composition and structure as the target are obtained by condensation of the vapor produced. A schematic view to describe the phenomena (heating and vaporization) produced by the impinging of laser beam on a complex target (alloys or compounds) is proposed. The experimental results are in accordance with this model. (FR)

15192 PARAMAGNETIC RESONANCE LINEWIDTH OF EuO NEAR THE CURIE TEMPERATURE. Seehra, M. S.; Sturm, D. W. (Univ. of West Virginia, Morgantown). J. Phys. Chem. Solids; 36: No. 11, 1161-1163(Nov 1975).

Measurements of the EPR linewidth ΔH of EuO at 9 GHz are reported in the temperature range of 66 to 300°K, with particular attention to the region near T_c (69.6°K). Comparison with the earlier data of Eastman at 25 GHz in the critical region shows considerable suppression of ΔH at 25 GHz. The temperature-dependent behavior of ΔH in EuO at 9 GHz is similar to the observations in $CrBr_3$ and it is in qualitative agreement with the zero-field predictions of Huber and Maleev. The quantitative discrepancies are believed to be due to the effect of the resonance magnetic field on EPR spin dynamics near T_c and an inadequate decoupling of the four-spin correlation functions used in the theories. (auth)

15193 NEUTRON IRRADIATION-INDUCED VOIDS IN beta-SILICON CARBIDE. Price, R. J. Norelco Rep.; 21: No. 1, 15-19(Sep 1974).

The formation of voids in irradiated SiC strongly resembles void formation in highly irradiated metals. In SiC, as in metals, the voids are bounded by crystallographic planes; they only form when a threshold temperature (between 1000 and 1250°C for SiC) is exceeded; they are absent from grain boundary regions; their mean size increases and their concentration decreases as the irradiation temperature increases. For a given irradiation temperature, the increase in void density with increasing fluence and the presence of the smallest resolvable voids in the high-fluence samples show that nucleation continues to high fluences. No dislocation loops or tangles could be definitely identified after irradiation or after post-irradiation annealing. The effects of annealing on the voids first become measurable at 1700 to 1800°C for annealing times of 1 h. This is the approximate temperature range where self-diffusion first becomes appreciable in SiC. (Metals Abstr.)

15194 STRUCTURAL PRINCIPLES IN REFRACTORY BORIDES. Matkovich, V. I. (Carborundum Co., Niagara Falls, NY). pp 525-545 of Boron Chemistry. Vol. II. Wallbridge, M. G. H. (ed.). London; The Butterworth Group (1975).

From 2nd international meeting on boron chemistry; Leeds, UK (25 Mar 1974). See CONF-740380-.

The role of polyatomic groups in refractory borides is examined. Various arrangements of icosahedral boron groups are reviewed with emphasis on the crystal chemistry of these structures. It is demonstrated that formal presentation of lower borides in terms of tetrahedra (four metal atoms or two metal and two boron atoms) can be utilized to simplify understanding of these structures and to show relationship among structures that otherwise appear unrelated. It is shown that the M_2B_2 configuration appears in a great majority of lower borides. Some principles on which these structures are built are described. (6 tables, 67 references) (auth)

15195 YIELD POINTS AND STRAIN AGING IN HEXAGONAL-BASED PARTICULATE COMPOSITES. Huseby, I. C. (General Electric Corporate Research and Development Center, Schenectady, NY.); Hsu, S. E.; McNelley, T. R.; Edwards, G. R.; Francois, D.; Shyne, J. C.; Sherby, O. D. Metall. Trans., A; 6A: No. 11, 2005-2008(Nov 1975).

Initial and strain-aging yield points have been observed and studied for three hexagonal-based particulate composites: Cd–30 vol percent B, Mg–25 vol percent B, and Zn–15 vol percent Al_2O_3. The strain-aging yield points begin to appear at 0.5 to 0.6T/sub m/ and persist up to the melting temperature. These effects are associated with the large volume fraction of hard particles, which are considered to be a primary source of dislocations and vacancies; strain aging yield points are attributed to the resulting decrease in mobile dislocation density, by annihilation or interaction with imperfections other than impurity atoms, which occur during aging after straining. (auth)

15196 RADIATION DEFECTS IN γ-IRRADIATED SINGLE CRYSTALS OF YTTRIUM–ALUMINUM GARNET. Karaseva, L. G.; Saunin, E. L.; Gromov, V. V.; Anisimov, N. A. (Inst. of Physical Chemistry, Moscow). High Energy Chem. (USSR) (Engl. Transl.); 9: No. 1, 39-41(1975).

Translated from Khim. Vys. Energ.; 9: No. 1, 51-54(1975).

The electron spin resonance (ESR) method was used to study the nature, accumulation rate, and thermal stability of paramagnetic centers (PMC) produced by the γ-irradiation of single crystals of yttrium-aluminum garnet (YAG) both in the pure form and containing additions of the rare earth elements (REE) Nd and Ce. It was found that in all the YAG crystals studied exposure to γ-radiation produces at least two types of electron-hole centers localized on matrix defects. Changes in the PMC concentration resulting from the addition of REE are related to the electron affinity of REE trivalent ions. (auth)

15197 CONTRIBUTION TO X-RAY RADIOGRAPHIC INVESTIGATIONS OF BINDING METALS IN TUNGSTEN CARBIDE–COBALT–ALLOYS. Willbrand, J.; Wieland, U. (Krupp (Friedr.) G.m.b.H., Essen (F. R. Germany). Forschungsinstitut). Tech. Mitt. Krupp, Forschungsber.; 33: No. 1, 41-44(Jun 1975). (In German).

3 figs.; 2 tabs.; 8 refs.

X-ray radiographic determination of lattice constants in cubic and hexagonal cobalt-tungsten-carbide model alloys was accomplished. Calibration curves were established for the determination of the content of dilute tungsten and carbon. Calculated and experimental lattice constants of isolated hard metals were compared. (DE)

15198 NEW CLASS OF COMBUSTION PROCESSES. Merzhanov, A. G.; Borovinskaya, I. P. (Inst. of Chemical Physics, Moscow). Combust. Sci. Technol.; 10: No. 5/6, 195-201(1975).

A short review is given of the results of work carried out since 1967 on studying the combustion processes caused by the interaction of chemical elements in the condensed phase and leading to the formation of refractory compounds. New phenomena and processes are described which are revealed when investigating the combustion of the systems of this class, viz solid-phase combustion, fast combustion in the condensed phase, filtering combustion, combustion in liquid nitrogen, spinning combustion, self-oscillating combustion, and repeated combustion. A new direction in employment of combustion processes is discussed, viz. a self-propagating high-temperature synthesis of refractory nitrides, carbides, borides, silicides and other compounds.

15199 DUCTILITY AND SERVICE LIFE BEHAVIOR OF A HARD METAL ALLOY IN DEPENDENCE ON THE MICROSTRUCTURE FORMATION. Grewe, H. (Deutsche Edelstahlwerke A. G., Krefeld (F. R. Germany)). Metall; 28: No. 10, 979-986(Oct 1974). (In German).

9 figs.; 5 tabs.; 6 refs.

The alloy investigated had the following composition: 76 wt.% WC, 10 wt.% Co, 14 wt.% carbides of the 4th and 5th main group metals in the periodic table (TiC, TaC). In sintering and annealing tests, the change of the alloy properties (hardness, porosity, density, coercive field strength, saturation magnetization, bending strength), the change of sintering time and sintering temperature, or of annealing time and temperature, was investigated. From the results, an optimum region of ductile properties depending on the coercive field strength and microstructure formation was determined. To explain the service life behavior, turning tests on steel with a tensile strength of 100 kp/mm^2 were carried out in which the sintering and annealing test samples were used as cutting materials. The free surface wear slightly increased with increasing microstructure enlargement of the cutting material whereas the oxidative wear is considerably reduced. (DE)

15200 PREDICTED SUPERCONDUCTING T_c OF 31-35 K FOR A β-W TYPE Nb_3Si. Geller, S. (Colorado Univ., Boulder (USA). Dept. of Electrical Engineering). Appl. Phys.; 7: No. 4, 321-322(Aug 1975).

13 refs.

A simple empirical approach indicates that a stoichiometric β-W type Nb_3Si should have a superconducting transition temperature of between 31 and 35°K. Thus far, several experimental approaches have failed to produce the compound which should have a lattice constant of 5.06 ± 0.02 A. (DE)

15201 REACTION EQUILIBRIA AND THERMODYNAMIC INVESTIGATIONS IN THE SYSTEMS URANIUM-OSMIUM-CARBON AND URANIUM-IRIDIUM-CARBON. Holleck, H.; Kleykamp, H.; Franco, J. I. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung). Z. Metallkd.; 66: No. 5, 298-302(May 1975). (In German).

9 figs.; 1 tab.; 30 refs.

Isothermal sections of the ternary system U-Os-C at 1,500°C and of U-Ir-C at 1,300°C are presented. The diagrams are determined by the ternary complex carbides U_2OsC_2 and U_2IrC_2 which are in equilibrium with UC, U_2C_3, C, Os, UOs_2, and UC, U_2C_3, C, UIr_2 and UIr, respectively. Thermodynamic investigations of the UOs_2, UIr_2 and UIr_3 intermetallic compounds were made by measuring the emf of second type galvanic cells using a solid electrolyte. The Gibbs energy of formation between 950 and 1,140 K was determined. (DE)

15202 CRYSTALLOGRAPHIC INVESTIGATION OF TERNARY TITANIUM VANADIUM HYDRIDES. Nagel, H.; Perkins, R. S. (Max-Planck-Institut fuer Metallforschung, Stuttgart (F. R. Germany). Inst. fuer Werkstoffwissenschaften; Brown, Boveri and Co. Ltd., Baden (Switzerland). Research Center). Z. Metallkd.; 66: No. 6, 362-366(Jun 1975).

6 figs.; 2 tabs.; 15 refs. Part of a thesis by H. Nagel.

Crystallographic measurements have been made on ternary titanium vanadium hydrides $Ti_{1-y}V_yH_x$ in the range $0 < y < 0.5$ and with a hydrogen to metal ratio from 1.6 to 1.92. The lattice constants have been determined by x-ray means in the temperature interval from 80 to 440°K. In addition neutron diffraction measurements were made on two ternary deuterides. The measurements show that the transition from the cubic γ-phase to the tetragonal δ-phase observed in the binary system Ti-H is strongly influenced by a partial substitution of titanium by vanadium. The stability range of the tetragonal δ-phase is shifted to lower H/Me values with increasing vanadium concentration V/Me (Me = V + Ti). The tetragonal phase does not occur for V/Me values of 0.35 and 0.5. Phase boundaries were determined at room temperature between the cubic and the tetragonal dihydride phase as well as between these two phases and the two phase region with the α-titanium. (DE)

15203 COMPOSITION OF THE CUBIC NITRIDE IN THE SYSTEM NICKEL-TANTALUM-NITROGEN. Stadelmaier, H. H.; Shugart, J. C.; Kotyk, M.; Fiedler, M. L. (North Carolina State Univ., Raleigh (USA). Dept. of Materials Engineering; North Carolina State Univ., Raleigh (USA). Engineering Research Services Div.). Z. Metallkd.; 66: No. 8, 487-488(Aug 1975).

1 fig.; 11 refs.

In arc-melted nickel-tantalum-nitrogen alloys annealed at 1,000°C and water quenched, the composition of the ternary nitride corresponds to Ni_2Ta_4N and its structure is that of a filled $NiTi_2$ (η-carbide) type with a lattice constant between 11.547 and 11.556 A. A binary phase with the $NiTi_2$ structure type is not observed. The effect of contamination by oxygen is discussed. (DE)

15204 PHYSICAL METHOD FOR INTEGRAL PHASE ANALYSIS. Kloyber, H.; Skalicky, P. (Technische Hochschule, Vienna (Austria). Inst. fuer Angewandte Physik); Ebel, H. (Technische Hochschule, Vienna (Austria). Inst. fuer Technische Physik). Kerntechnik; 17: No. 6, 266-268(Jun 1975).

7 figs.; 2 refs.

The serpentine content of shielding concrete is difficult to determine, since diffraction methods and chemical analysis are not applicable. A method which is based on Delesse's principle was therefore used. High contrast photographs of polished samples were taken on which only the serpentine grains are in contrast. The area which they cover in the cut plane was subsequently determined by x-ray fluorescence analysis of the Ag-content in the photographic emulsions. After appropriate calibration the method can be applied to all problems of phase analysis. (DE)

15205 STRUCTURE OF THE SUBNITRIDE $Nb_{32}N_3$ BY ELECTRON DIFFRACTION. Ortiz, C.; Steeb, S. (Max-Planck-Institut fuer Metallforschung, Stuttgart (F. R. Germany). Inst. fuer Werkstoffwissenschaften). Z. Metallkd.; 66: No. 8, 460-462(Aug 1975). (In German).

7 figs.; 1 tab.; 7 refs. Part of a thesis by Ortiz, C.

Superstructure diagrams were obtained by electron diffraction (50 kV) from electrolytically thinned specimens of niobium which had been charged isothermally in the temperature range between 280 and 350°C, using 5×10^{-4} Torr partial pressure of nitrogen. Evaluation of these diagrams showed that there is a slight tetragonal distortion of the superstructure cell. The distribution of nitrogen atoms within this cell was determined by means of Patterson synthesis and the composition found to be $Nb_{32}N_3$. The mean atomic volume agrees well with the known composition dependence of atomic volume in the system Nb-N. By means of transmission electron microscopy, it was shown that the subnitride forms lens-shaped precipitates. (DE)

15206 TERNARY SYSTEM NICKEL-TUNGSTEN-CARBON. Fiedler, M. L.; Stadelmaier, H. H. (North Carolina State Univ., Raleigh (USA). Engineering Research Services Div.). Z. Metallkd.; 66: No. 7, 402-404(Jul 1975).

5 figs.; 1 tab.; 13 refs.

To gain definitive information on the carbide compositions, the nickel-tungsten-carbon system was re-examined by determining a liquidus projection and an isothermal section at 1,300°C. The liquidus projection shows extended fields of primary tungsten and WC enclosing a smaller field of peritectically formed η-carbide Ni_2W_4C. In alloys quenched from 1,300°C, three ternary phases were observed: two cubic η-carbides and a hexagonal χ-carbide. One η-carbide is Ni_6W_6C ($M_{12}C$) with a lattice constant of 10.900 ± 0.004 A, the other is Ni_2W_4C (M_6C) with a variable nickel-to-tungsten atomic ratio and a lattice parameter ranging from 11.226 ± 0.005 A at the nickel-rich end to 11.257 ± 0.007 A at the tungsten-rich end. The hexagonal χ-carbide was found at a composition corresponding to NiW_3C and has lattice constants a = c = 7.837 ± 0.001 A. (DE)

15207 PHASE RELATIONSHIPS IN THE ZIRCONIA–YTTRIA SYSTEM. Scott, H. G. (Commonwealth Scientific and Industrial Research Organization, Fisherman's Bend, Australia). J. Mater. Sci.; 10: No. 9, 1527-1535(Sep 1975).

Metastable and equilibrium phase relationships in the system ZrO_2:$YO_{1.5}$ have been studied by x-ray diffraction. The conditions for the retention of a zirconia-rich tetragonal phase at ambient temperature are established. The existence of a miscibility gap, closed below the solidus temperature, in the yttria-rich solid solution region is proposed. Some evidence for partially ordered phases is presented. (auth)

15208 SUPERCONDUCTIVITY OF $TaS_{2-x}Se_x$ LAYER COMPOUNDS AT HIGH PRESSURE. Smith, T. F. (Univ. of California, La Jolla, San Diego); Shelton, R. N.; Schwall, R. E. J. Phys., F. (London); 5: No. 9, 1713-1725(Sep 1975).

The superconducting transition temperatures for layer compounds in the system $TaS_{2-x}Se_2$ have been measured as a function of hydrostatic pressure up to 25 kbar. When the coordination of the metal atoms is purely trigonal prismatic, T_c is strongly enhanced by pressure, whereas for mixed octahedral-trigonal prismatic coordination the increase of T_c is very much smaller. Increasing the interlayer spacing by intercalation reduces the influence of pressure upon T_c such that for expansions ≥ 6 Å, T_c is essentially independent of pressure. It is suggested that an increase in the overlap of the d_{z^2} wavefunctions in the interlayer region is responsible for the increase of T_c. (auth)

15209 SUPERCONDUCTIVITY IN THE $Re_xMo_6S_8$. Fischer, O. (Geneva Univ.); Treyvaud, A.; Chevrel, R.; Sergent, M. Solid State Commun.; 17: No. 6, 721-724(15 Sep 1975).

The rare earth molybdenum sulfides $RE_xMo_6S_8$(RE = rare earth) have been synthesized and are found to be superconducting with a few exceptions. This result, which is surprising in view of the high concentration of magnetic ions, is correlated with the particular structure of these compounds based on units of Mo_6S_8. (auth)

15210 LOWER CRITICAL FIELD H_{c1} OF V_3Si. Eckert, D.; Berthel, K. H. (Akademie der Wissenschaften der DDR, Dresden). Cryogenics; 15: No. 8, 479-480(Aug 1975).

The temperature dependence of the lower critical field H_{c1} of V_3Si single crystals was investigated. Measurements were carried out using an alternating field method. Superposition of a small alternating field onto an outer magnetic field arising linearly in time makes it possible to detect flux changes in hard superconductors with a high degree of sensitivity. (auth)

15211 THERMODYNAMIC DOMAINS OF THE VARIOUS SOLID DEPOSITS IN THE B–C–H–Cl VAPOR SYSTEM. Ducarroir, M. (CNRS, Font-Romeu, France); Bernard, C. pp 72-83 of Chemical Vapor Deposition. Blocher, J. M. Jr.; Hintermann, H. E.; Hall, L. H. (eds.). Princeton, NJ; The Electrochemical Society, Inc. (1975).

From 5th international conference on chemistry vapor deposition; Burkinghamshire, UK (21 Sep 1975). See CONF-750991-.

Calculations were made of the equilibrium conditions under which chemical deposition of B_4C from BCl_3–CH_4–H_2 mixtures takes place. Pure B_4C is mainly obtained for gas phase mixtures in which BCl_3/CH_4 greater than 1 and H_2/BCl_3 greater than 1. The maximum yield is obtained in the range 1675–2075K for the initial composition BCl_3 equals 0.1; CH_4 equals 0.002; H_2 equals 0.88. The dependence of the hydrogen partial pressure on the equilibrium composition is discussed. At high temperatures with a large excess of hydrogen, the tendency is to form gaseous BH_2 and BH_3 instead of condensed species. By decreasing the amount of hydrogen, graphite begins to deposit under CH_4/BCl_3 much less than 1/4 ratios. At lower temperatures the equilibrium content of BCl_2H increases as the H_2/BCl_3 ratio falls. Results of the calculations are confirmed by experimental data. (auth)

15212 LOW TEMPERATURE DEPOSITION OF METAL NITRIDES BY THERMAL DECOMPOSITION OF ORGANOMETALLIC COMPOUNDS. Sugiyama, K.; Pac, S.; Takahashi, Y.; Motojima, S. (Gifu Univ., Kagamigahara, Japan). pp 147-160 of Chemical Vapor Deposition. Blocher, J. M. Jr.; Hintermann, H. E.; Hall, L. H. (eds.). Princeton, NJ; The Electrochemical Society, Inc. (1975).

From 5th international conference on chemistry vapor deposition; Burkinghamshire, UK (21 Sep 1975). See CONF-750991-.

Decomposition reaction of dialkylamides of boron, silicon, tin, titanium, zirconium, niobium, and tantalum was investigated. The amides of transition metals decomposed to the corresponding nitrides at 300–500°C, although those of a typical group afforded elements themselves at higher temperatures in most cases. In the temperature dependence of the nitride deposition from tetrakis (dimethylamido)titanium(IV), two optimum temperature conditions were found at 400°C and at a temperature higher than 800°C in nitrogen or hydrogen atmosphere, but in argon low temperature deposition alone was possible. The low and high temperature processes are discussed in relation with the mass spectral analysis of the exhaust gases formed at the different temperature decompositions of the titanium amide. (auth)

15213 INDIUM OXIDE DEPOSITION ON GLASS BY AEROSOL PYROLYSIS (PYROSOL(R) PROCESS). Blandenet, G.; Lagarde, Y.; Spitz, J. (CEN, Grenoble, France). pp 190-203 of Chemical Vapor Deposition. Blocher, J. M. Jr.; Hintermann, H. E.; Hall, L. H. (eds.). Princeton, NJ; The Electrochemical Society, Inc. (1975).

From 5th international conference on chemistry vapor deposition; Burkinghamshire, UK (21 Sep 1975). See CONF-750991-.

The Pyrosol(R) process involves the pyrolysis of an aerosol generated by ultrasonic nebulisation from a solution of organic or inorganic compounds. This technique was used to deposit transparent n-conducting indium oxide films on glass. The electrical and optical properties of these films were studied as a function of the deposition temperature and doping (using tin or fluorine). A deposition temperature of 480°C and a Sn/In ratio of about 5% gave the best results. In this case, the transmission in the visible range was 92%, the infrared reflection 84% and the electrical resistivity 1.7×10^{-4} Ω cm. (auth)

15214 PREPARATION OF NIOBIUM NITRIDE AND NIOBIUM CARBONITRIDE THIN FILMS BY REACTIVE SPUTTERING. Spitz, J.; Aubert, A. (CEN, Grenoble, France). pp 258-269 of Chemical Vapor Deposition. Blocher, J. M. Jr.; Hintermann, H. E.; Hall, L. H. (eds.). Princeton, NJ; The Electrochemical Society, Inc. (1975).

From 5th international conference on chemistry vapor deposition; Burkinghamshire, UK (21 Sep 1975). See CONF-750991-.

The preparation of niobium nitride and carbonitride thin films by reactive sputtering either of a niobium or niobium-carbon target under partial pressure of nitrogen or nitrogen + methane has been studied. The influence of the experimental conditions on composition, structure, and electrical properties of the deposited materials are investigated in each case. The correlations observed between the nature of the deposited materials and their superconductive properties are related. (11 fig) (auth)

15215 DISPERSION OF BORON CARBIDE IN A TUNGSTEN CARBIDE/COBALT MATRIX. Arthur, G.; Johnson, M. P. (International Research and Development Co., Ltd., Newcastle-upon-Tyne, Eng.). pp 509-522 of Chemical Vapor Deposition. Blocher, J. M. Jr.; Hintermann, H. E.; Hall, L. H. (eds.). Princeton, NJ; The Electrochemical Society, Inc. (1975).

From 5th international conference on chemistry vapor deposition; Burkinghamshire, UK (21 Sep 1975). See CONF-750991-.

Particles of boron carbide (105-125 microns) were coated with a layer (10-12 microns) of titanium carbide in a fluidized bed. These coated particles have been successfully incorporated in a tungsten carbide–cobalt matrix by hot pressing at 1 tonf/in² (15.44 MN/m²) at 1350°C. Attempts to produce a similar material by a cold pressing and sintering technique were unsuccessful because of penetration of the titanium carbide layer by liquid cobalt. Hot-pressed material containing boron carbide had a static strength in bend of approximately 175,000 lbf/in² (1206 MN/m²) which compares favorably with the strength of conventionally produced tungsten carbide/cobalt. The impact strength of the material containing boron carbide was however considerably lower than tungsten carbide/cobalt. In rock drilling tests on Darley Dale sandstone at low speeds and low loads, the material containing boron carbide drilled almost ten times as far without seizure as tungsten carbide/cobalt. In higher speed and higher load rotary drilling tests conducted by the National Coal Board, the material containing boron carbide chipped badly compared with normal NCB hardgrade material. (auth)

15216 CHEMICAL VAPOR DEPOSITION OF TUNGSTEN CARBIDE (WC). Mantle, H.; Gass, H.; Hintermann, H. E. (Laboratoire Suisse de Recherches Horlogeress, Neuchatel, Swit-

zerland). pp 540-555 of Chemical Vapor Deposition. Blocher, J. M. Jr.; Hintermann, H. E.; Hall, L. H. (eds.). Princeton, NJ; The Electrochemical Society, Inc. (1975).

From 5th international conference on chemistry vapor deposition; Burkinghamshire, UK (21 Sep 1975). See CONF-750991-.

Experiments were carried out to produce pure monophasic WC layers by the CVD process using the $H_2-WCl_6-CH_4$ system. The WCl_6 was prepared "in situ" and mixed directly above the specimens to be coated, with H_2 and CH_4. As thermodynamically predicted, the decomposition and reduction of the tungsten chlorides involved posed practical problems and limited the range of deposition conditions. Under certain conditions, with the cemented carbide and CVD TiC-coated cemented carbide substrates employed, pure monophasic WC layers could be obtained but only when a W_2C or W layer existed on the substrate. Low temperature flow visualization experiments indicated that this could be a result of nonuniform gas mixing and flow conditions. The latter were found to depend critically on the geometrical arrangement in the reactor, reactant concentrations, and system pressure. (13 fig) (auth)

15217 TUNGSTEN CARBIDE COATINGS ON STEEL. Archer, N. J. (Fulmer Research Inst., Buckinghamshire, Eng.). pp 556-573 of Chemical Vapor Deposition. Blocher, J. M. Jr.; Hintermann, H. E.; Hall, L. H. (eds.). Princeton, NJ; The Electrochemical Society, Inc. (1975).

From 5th international conference on chemistry vapor deposition; Burkinghamshire, UK (21 Sep 1975). See CONF-750991-.

It has been shown that tungsten carbide is deposited exclusively in the form W_2C from the gas phase by the reaction between tungsten hexafluoride, hydrogen and an aromatic hydrocarbon, such as benzene, in the temperature range 400-700°C. Coherent layers of W_2C with thickness up to 100 μm and hardness of about 2300 V. P. N. can be obtained. The coatings have been shown to have low porosity with columnar grains growing perpendicular to substrate surface. Good adhesion to steel substrates is obtained by the use of a thin nickel interlayer. The relatively low deposition temperature makes it possible to coat tool steels without annealing them. This, combined with the possibility of coating thickness which can be ground or polished to a precise final size and surface finish, makes tungsten carbide very suitable for wear-resistant applications on high-precision components. (auth)

15218 CHEMICAL VAPOR DEPOSITION OF HAFNIUM NITRIDE AND HAFNIUM CARBIDE ON TUNGSTEN WIRES. Hakim, M. J. (Westinghouse Canada Ltd., Hamilton, Ontario). pp 634-649 of Chemical Vapor Deposition. Blocher, J. M. Jr.; Hintermann, H. E.; Hall, L. H. (eds.). Princeton, NJ; The Electrochemical Society, Inc. (1975).

From 5th international conference on chemistry vapor deposition; Burkinghamshire, UK (21 Sep 1975). See CONF-750991-.

Uniform and adherent deposits of HfN and HfC were deposited on W-2% ThO_2 wires by the reaction of H_2 and N_2 or CH_4 with chlorides of hafnium generated in situ by the reaction of HCl with Hf metal at 700°C, in the range of temperatures 900 to 1300°C for HfN and 1000° to 1300°C for HfC respectively. The dependence of the rates of deposition, morphologies, microstructures, and stoichiometries on the deposition parameters were investigated. Processes for the deposition of HfN and HfC are shown to be mass transport limited at low concentrations of hydrogen. The effect of HfN and HfC coatings on the wire properties has also been discussed. (19 fig) (auth)

15219 CHEMICAL VAPOR DEPOSITION OF NbB_2 AND TaB_2 THROUGH HEATING BY CONCENTRATION OF SOLAR RADIATION. Armas, B.; Combescure, C.; Trombe, F. (CNRS-ODEILLO, Font-Romeu, France). pp 695-703 of Chemical Vapor Deposition. Blocher, J. M. Jr.; Hintermann, H. E.; Hall, L. H. (eds.). Princeton, NJ; The Electrochemical Society, Inc. (1975).

From 5th international conference on chemistry vapor deposition; Burkinghamshire, UK (21 Sep 1975). See CONF-750991-.

NbB_2 or TaB_2 can be derived from a mixture of BBr_3 and NbBr and $TaBr_5$ by thermal dissociation. Reactions are carried out at low pressure and without hydrogen. A description is given of a synthesis device which uses the concentration of solar radiation as the heating procedure. The effect of different experimental parameters is discussed. It is shown how to obtain a compact, adhesive diboride or oriented deposits. Development of microcrystals were observed which look like 15-20 μm hexagonal basis pyramids. (auth)

15220 PYROLYTIC BORON NITRIDE: CONCERNING ITS OPERATING LIMITS AT HIGH TEMPERATURE IN VACUUM. Clerc, G.; Gerlach, P. (Thomson-CSF, Paris). pp 777-785 of Chemical Vapor Deposition. Blocher, J. M. Jr.; Hintermann, H. E.; Hall, L. H. (eds.). Princeton, NJ; The Electrochemical Society, Inc. (1975).

From 5th international conference on chemistry vapor deposition; Burkinghamshire, UK (21 Sep 1975). See CONF-750991-.

This study investigates the chemical stability of pyrolytic boron nitride obtained from BCl_3-NH_3 reaction. BN in contact with refractory metals is unstable at high temperature, but should be stable with ceramics (Al_2O_3, etc) above 800°C. (DLC)

Metals and Alloys

Refer also to abstract 15173.

15221 (AD/A-015476) CRITICAL REVIEW OF URANIUM RESEARCH AT DREV FOR THE PERIOD 1963-1973. Drolet, J. P. (Defence Research Establishment Valcartier, Courcelette, Quebec (Canada)). Jul 1975. 54p. (PD-18785). NTIS.

Summarizing a decade of internal and sponsored uranium research at DREV, this paper covers more than 25 reports on in-house and research investigations made under contracts and university grants. The paper, which gives a broad overview of Canadian achievements in this area, is divided into five parts. The first is concerned with alloy developments, i.e. the heat-treatment responses of more than 100 binary, ternary, and quaternary uranium alloys, whereas the second and the third cover more extensive investigations of the two most promising alloys, the quaternary U-1Mo-1Zr-1Nb and the binary U-2Mo. Various other aspects of uranium metallurgy, such as powder metallurgy, grain growth, pyrophoricity, and directional casting, are briefly described in the fourth section. A list of the most important results obtained during the course of these investigations is presented in the final section. (20 figures, 34 references). (auth)

15222 (CNLM-6066) MELTING RECORD GC-68, NOMINAL COMPOSITION Cb-0.85Zr-0.112C. Maynard, W. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 5 Jan 1965. Contract AT(30-1)-2789. 3p. Dep. NTIS $3.50.

Declassified 12 Jan 1976.

Melting of Nb-0.85Zr-0.112C is reported. Electrode behavior is described. (DLC)

Corrosion and Erosion

Refer also to abstracts 15353, 16249, and 16257.

15223 (AEC-tr-7295, pp 109-115) CORROSION KINETICS OF STAINLESS STEELS AND ALUMINUM IN N_2O_4. Sukhotin, A. M.; Lantratova, N. Ya.; Antropov, N. P.; Samoilyuk, P. P. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli i Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

A resistance-measurement method was developed for determining low corrosion rates of thin wires in N_2O_4 atmospheres. Tests were performed on 0,1-0.2 mm dia wires; data are presented for Al, Kh18N10T, and 2Kh13N1MV1 in liquid and gaseous N_2O_4. Effects of passivation were studied. (DLC)

15224 (AEC-tr-7295, pp 116-123) STABILITY OF CONSTRUCTION MATERIALS IN N_2O_4 AT HIGH PRESSURES AND TEMPERATURES. Sukhotin, A. M.; Lantratova, N. Ya.; Matushkin, V. A.; Polyakova, R. E.; Laterner, S. A. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli i Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press. Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

Corrosion stability of Cr-Ni steels, Cr steels, Ni alloys, Al alloys, and Ti alloys in gaseous equilibrium nitrogen oxides was studied up to 700°C and 150 atm. (DLC)

15225 (CNLM-3922) ALKALI METAL CORROSION RESEARCH. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). [nd]. 3p. Dep. NTIS $3.50.

Declassified 9 Jan 1976.

Corrosion studies and chemical analysis are described in support of the lithium-cooled reactor experiment. Results indicate that Nb-1Zr alloy should be an excellent containment material for hot lithium. (DLC)

15226 (FRNC-TH-550) SPATIAL MODULATION OF THE PHYSICAL ADSORPTION POTENTIAL BY DIFFUSION AND THE THEORETICAL CONSEQUENCES ON MULTILAYER ADSORPTION. Deloche, Daniel. (Grenoble-1 Univ., 38 (France)). 1973. 103p. (In French). INIS.

The spatial variations of the adsorption potential parallel to the adsorbing surface were studied by measurement of the superficial diffusion coefficient. The force of attraction induced at the surface of the adsorbed film as a function of the geometry of the substrate was then examined in a non-uniform multilayer adsorption model. The superficial diffusion coefficient was determined by the use of a radioactive tracer which gives direct information without perturbing the measurement. It was shown that tritium can be physisorbed in mobile form at low temperature on monocrystalline nickel without subjacent chemisorption. Similarly krypton at 40°K is adsorbed on graphite with a mobility strongly dependent on the degree of coverage. The potential barrier between sites, for krypton adsorbed in two-dimensional gas form, lies in the region of 250 calories per mole. With regard to multilayer adsorption the above-mentioned force of attraction, entropie in origin, must be added to the Van der Waals forces to obtain the adsorption isotherms. A theory of this pseudo-force is given for a gas adsorbed on a solid surface, based on the BET model (Brunauer, Emmett and Teller) but accounting for lateral interactions in a molecular field approximation. (FR)

15227 (WARD-NA-3045-26) SODIUM TECHNOLOGY PROGRAM: COMPONENT MATERIALS COMPATIBILITY. Quarterly Progress Report for Period Ending April 30, 1975. Ray, W. E. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Nov 1975. Contract E(11-1)-3045. 74p. AT.

1. Interstitial Transfer: A series of short-term exposures were performed in CEL-2 in an effort to determine the reason for the carburization of ITF-5 specimens. It appears that incomplete alcohol cleaning after sodium exposure can cause carburization of stainless steel. Run ITF-6 continued with specimens in the IHX, secondary heater, and by-pass sections accumulating approximately 2250 hours of exposure. The primary heater samples have been exposed for about 1560 hours. CEL-1 and CEL-2 experiments revealed two important facts related to the use of 2¼ Cr-1 Mo alloy in the LMFBR: Annealed material has a stable structure and will not lose carbon in sodium at 950°F to levels which would require modification of allowable stresses. Secondly, normalized or normalized and tempered structures, especially those experiencing an initial rapid cooling, are unstable at steam generator temperatures and are prone to serious decarburization and mechanical property degradation. X-ray microprobe analysis of ITF-4 and -5 indicate considerable departure from corrosion trends established earlier. 2. Sodium Effects on Mechanical Properties: Four tests of Inconel 718 in the MTS fatigue machine at 1000°F yielded typical hysteresis loops for load-strain plots. The strain range vs fatigue life curve showed that the elastic and plastic strain ranges obey a linear relationship when plotted on logarithmic coordinates. Low cycle-fatigue tests on Type 316 stainless steel at 1100°F in flowing sodium show that samples pre-treated at 1200°F have a greater creep/fatigue life than those pre-treated at 1325°F. Since the samples pretreated at 1325°F are weaker and more ductile than those pretreated at 1200°F, the trend is consistent in that increased ductility increases the fatigue life, whereas decreased strength decreases the creep life. 29 fig, 6 tables (DLC)

15228 ENVIRONMENTALLY INDUCED FRACTURE OF ZIRCALOY BY IODINE AND CESIUM: THE EFFECTS OF STRAIN RATE, LOCALIZED STRESSES AND TEMPERATURE. Wood, J. C.; Surette, B. A.; London, I. M.; Baird, J. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). J. Nucl. Mater.; 57: No. 2, 155-179(Aug 1975).

The fracture of Zircaloy-2 fuel-sheathing was studied with and without iodine or cesium present. An apparatus that simulated localized stresses and strains in the sheathing such as occur due to the thermal expansion and cracking of UO_2 fuel pellets during a power ramp in-reactor was used. At 225-550°C the combined effects of iodide and localized stresses produced a wide range of strains to failure at a given average strain rate, the upper limit of which decreased with decreasing strain rates in the range 10^{-3}-10^{-7} sec^{-1}. Three types of fractures were identified, transgranular cleavage, intergranular cracking, and ductile fracture. A similar study was attempted using cesium as the corrodant but only ductile fracture resulted. However cesium-induced cracking was observed in 25 mm thick, dynamically stressed double cantilever beam specimens in the temperature range 30-225°C but not at 250 and 300°C. Small cracks in intact irradiated fuel sheaths resembled transgranular iodine-induced cracks when viewed by optical microscopy and scanning electron microscopy. (NL)

15229 OXIDATION BEHAVIOR OF URANIUM IN AIR AT 50 TO 300°C. Bennett, M. J.; Myatt, B. L.; Silvester, D. R. V.; Antill, J. E. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). J. Nucl. Mater.; 57: No. 2, 221-236 (Aug 1975).

The oxidation behavior of adjusted uranium in air at 1 atm pressure has been examined at 50-300°C, with emphasis on the influence of water vapor at concentrations up to 3×10^4vpm. The work also covered the effects of prior irradiation of the metal. Temperature had the most pronounced effect and increased the rate of oxidation by a factor of over 10^6 from 50 to 300°C. Water vapor also increased the attack at 100-200°C by up to a factor of 7.5, but was without significant influence at 50, 75, and 300°C. The enhanced attack could be explained by the incorporation of hydroxyl ions in the oxide lattice or by the transitory formation of uranium hydride. Support for the latter explanation was provided by tests in wet air with defected cans containing uranium powder, where oxidant access was limited. The influence of irradiation, to a burn-up of 5600 MWd/t, was governed mainly by the magnitude of the associated swelling. It only became significant for the most swollen (17-21%) material examined, when it increased the attack by factors from 4 to 90. The mechanism involved the break-up of the uranium surface during oxidation. (NL)

15230 ANALYSIS OF THE DECARBURIZATION AND AGING PROCESSES IN 21/4 Cr-1 Mo STEEL. Klueh, R. L.; Leitnaker, J. M. (Oak Ridge National Lab., TN). Metall. Trans., 6A: No. 11, 2089-2093(Nov 1975).

Specimens of 2¼ Cr-1 Mo steel that had been decarburized in sodium or aged in an inert atmosphere for 26,500 h at 839°K were metallurgically examined with optical and transmission electron microscopy. The carbide particle density of the decarburized and aged specimens was considerably less after 26,500 h than after 10,000 h, with the density in the aged specimen being considerably greater than that in the decarburized specimen. For the aged specimen, the density decrease was a result of Ostwald ripening, and the total amount of carbide was not noticeably affected. Decarburization, however, resulted in a gradient in carbide density, with the smallest density near the surface. Carbides were electrolytically extracted and identified by x-ray diffraction. From the before-test material, which was in the annealed condition and had a ferrite-pearlite microstructure, 1.4 wt percent carbide was obtained. This sample contained M_3C, $M_{23}C_6$, and M_6C, with $M_{23}C_6$ constituting the major portion. In the aged specimen, 2.3 wt percent of precipitate was extracted and contained 60 percent M_6C, the balance $M_{23}C_6$. The decarburized specimen contained two regions with different carbide contents. The first 20 percent of the 1.6 mm thick specimen yielded 1.3 wt percent precipitate, which contained 94 percent M_6C, the balance $M_{23}C_6$. The interior of the specimen contained 1.6 wt percent precipitate, 86 percent M_6C. (auth)

15231 INFLUENCE OF pH AND SPECIMEN ORIENTATION ON CORROSION FATIGUE BEHAVIOR OF 18 PERCENT Ni (300) MARAGING STEEL IN CHLORIDE ENVIRONMENTS. Hasan, S. Z.; Ghali, E. L.; Dumais, J. SAMPE Q.; 7: No. 1, 20-27(Oct 1975).

The combined influence of cyclic stresses and seawater environment has been found to adversely affect the mechanical resistance of 18 percent Ni (300) maraging steel. Results from this investigation indicate that the corrosion fatigue behavior of the maraging steel can be described by an empirical relationship between cyclic stress (s) and time (t) as: t6cs/sup n/, where c and n are the constants. Pronounced effect of specimen orientation and pH on corrosion fatigue behavior of the above maraging steel has been found. Specimens tested with longitudinal orientation show longer fatigue life than specimens with transverse orientation in sodium chloride solutions (pH 7.4). The fatigue life was found to increase when the pH of the seawater was changed from 7.4 to 10.7. (auth)

15232 EROSION AND HEAT TRANSFER CHARACTERISTICS OF TUNGSTEN COATED STEEL. Haskell, R. W.; Imam, A. R. (Watervliet Arsenal, NY). pp 829-834 of Chemical Vapor Deposition. Blocher, J. M. Jr.; Hintermann, H. E.; Hall, L. H. (eds.). Princeton, NJ; The Electrochemical Society, Inc. (1975).

From 5th international conference on chemistry vapor deposition; Burkinghamshire, UK (21 Sep 1975). See CONF-750991-.

Tungsten coatings, produced by chemical vapor deposition, have been applied to steel cylinders for hot gas erosion studies. The coatings were applied at temperatures below the tempering temperature. Good adherence was attained using an electroplated nickel inner layer. The erosion mechanisms for the uncoated and coated steel cylinders are contrasted. Changes in the thermal characteristics produced by the tungsten coating are considered. (auth)

15233 PROPERTIES OF SUPERCONDUCTING WEAK LINKS PRODUCED BY ION IMPLANTATION. Harris, E.P. (IBM Thomas

J. Watson Research Center, Yorktown Heights, New York 10598). J. Vac. Sci. Technol. 12: No. 6, 1383-1386 (Nov 1975).

A new technique has been developed for making superconducting weak links, making use of the fact that the superconducting transition temperature (T_c) of certain metals (e.g., W, Mo) can be greatly increased by ion implantation. By implanting controlled patterns of N^+ and S^+ ions into Mo films, structures have been produced in which two heavily doped Mo regions with high T_c are joined by a short ($\lesssim 1\ \mu m$) lightly doped Mo region with lower T_c which acts as a weak link. These rugged and stable structures display the ac and dc Josephson effects. These techniques lend themselves to the production of superconducting integrated circuits containing weak links. (auth)

Preparation and Fabrication

Refer also to abstracts 15191, 15332, and 16529.

15234 (CONF-710994-P3) FIFTH SCIENTIFIC CONFERENCE VBS, OSTRAVA, CZECHOSLOVAKIA, SEPTEMBER 14–16, 1971. Volume III. Section on Nonferrous Metals and Nuclear Metallurgy. (Vysoka Skola Banska, Ostrava (Czechoslovakia). Ustav Nezeleznych Kovy a Jaderne Metalurgie). 1971. 296p. (In Several Languages).

Sixteen papers are presented that deal with various aspects of nonferrous metallurgy and nuclear science. Three papers were selected for inclusion in NSA. (SFL)

For abstracts of individual papers see: 14368, 15235, 16573.

15235 (CONF-710994-P3, pp 11-22) PREPARATION OF THE HIGHEST PURITY Nb. Barthel, J. (Zentralinstitut fuer Festkoerperphysik und Werkstofforschung, Dresden). 1971. (In German)

From 5th scientific conference of the institute of mining and metallurgy; Ostrava, Czechoslovakia (14 Sep 1971).

In fifth scientific conference VSB. Vol. III.

A method for the preparation of the highest purity Nb is described. It consists of the solvent extraction of Ta and other refractory elements normally associated with Nb after dissolution of the pentoxide. The purified Nb was then reprecipitated as the pentoxide and annealed. This was followed by a chlorination step to $NbCl_5$; the chloride was thermally decomposed and the resulting Nb was formed into thin rods suitable for electron beam zone melting for single crystal growth. The crystal was treated with a final annealing step in ultrahigh vacuum to remove all oxygen and other gases. (JSR)

15236 (IS-3623) CALCULATIONS CONCERNING PRECIPITATE GROWTH DURING IMPACT EXTRUSION. Scott, T. E. (Ames Lab., Iowa (USA)). Dec 1975. Contract W-7405-eng-82. 39p. Dep. NTIS $4.00.

An analysis of carbide particle growth during impact extrusion of 440A stainless steel was made and it was concluded that diffusion enhancements of the order of 8000 or more would be needed to produce particles with 25 A radii under such conditions. Deformation-induced excess vacancy enhanced diffusion was examined for the conditions of impact extrusion and it was learned that significant diffusion enhancement would not occur by this mechanism. Finally, dislocation "pipe" diffusion as a possible diffusion enhancement mechanism was evaluated. Although it would appear that "pipe" diffusion is capable of providing large enhancements, the experimental results were contradictory to the behavior predicted by the "pipe" diffusion model. The overall conclusion is that carbide particles cannot grow to physically meaningful sizes during impact extrusion. (auth)

15237 (NLCO-1128) FERROUS AND COMMON NONFERROUS METALS INDUSTRIES AND ASSOCIATED SCRAP METALS: A REVIEW. Mautz, E. E. (comp.). (National Lead Co. of Ohio, Cincinnati (USA)). Nov 1975. Contract E(30-1)-1156. 67p. Dep. NTIS $4.50.

Literature on the common metals industries, scrap metal relationships, and transportation aspects has been reviewed as background information in a study to determine the feasibility of a portable melting facility for radioactively contaminated metals. This report draws substantially on government-sponsored studies. Aluminum, copper, iron and steel, and nickel metal industries are discussed from the viewpoints of the general industry characteristics, primary metal production processes, and secondary metal processing aspects. 46 references, 10 tables. (auth)

15238 (ORNL-TM-5194) DEPOSITION PROFILES FROM ELECTRON-BEAM-HEATED EVAPORATION SOURCES. Reiley, T. C. (Oak Ridge National Lab., Tenn. (USA)). Jan 1976. Contract W-7405-eng-26. 16p. Dep. NTIS $4.50.

The thickness of physically vapor deposited copper and chromium specimens was measured as a function of position on a flat substrate situated above an electron-beam-heated evaporation source. The resulting profiles deviated from analytically predicted profiles based on the integrated mass flux from a flat surface of infinitesimal, directed surface sources. This deviation has been noted in the past and has been attributed to molecular interaction above the source. However, it is shown that the calculated molecular mean free path is much too long to allow any appreciable interaction of the evaporating molecules. Further, curvature of the molten source, arising from the surface recoil from evaporating molecules, is likely to be responsible for the difference between the observed and predicted profiles. (auth)

15239 USE OF BORON IN THE PRODUCTION OF LOW CARBON HIGH GRADE RIMMING STEEL. Smolyarenko, D. A.; Grekov, E. A.; Kolganov, G. S.; Kulikov, V. O. Stal; No. 8, 692-695(Aug 1974). (In Russian)

Theoretical and practical aspects of the treatment of 08kp steel with B to reduce the susceptibility of the steel to aging, are presented. The addition of B to low C steel, even in small quantities, (0.001 to 0.006%) improves the mechanical properties, while exerting no adverse effect upon the rimming action in the ingot molds. Low C rimming steel, containing B does not age, since N combines with the B to form stable B nitrides. (Metals Abstr.)

15240 HARNESSING PLASMAS FOR MOLYBDENUM EXTRACTION. Sci. Dimens.; 6: No. 1, 20-23(1974). (In English and French)

Molybdenum via the plasma route is obtained by injecting small particles of molybdenite (MoS_2) into the experimental reactor where it decomposes into Mo and gaseous S. The gaseous species then pass through a filter in the lower part of the reactor while the solids, including Mo, remain on the filter. Complexity of the plasma technology and studies of factors affecting the reactor design are discussed. The use of the production of TiC and other metals, such as W, Nb, Ta and Ti are considered. (Metals Abstr.)

15241 REVOLUTIONARY TECHNIQUE IN ANTI-WEAR TREATMENTS: WOLFRAMIZATION. Bacquias, G. Galvano-Organo; 43: No. 443, 351-353(Apr 1974). (In French)

A process is described for the electrodeposition of a W- based alloy which diffuses into the base metal to produce a wear-resistant coating. The properties of the deposit and the operating parameters of the process are considered. Some fields of application are enumerated. (Metals Abstr.)

15242 EXPERIMENTAL INVESTIGATION OF THE DISTRIBUTION OF ELEMENTS IN THE STRUCTURE OF CAST IRON. Ivanov, D. P.; Vashukov, I. A. Liteinoe Proizvod.; No. 7, 32-35(Jul 1974). (In Russian)

The distribution of sp-elements Al, Si, Ga, Ge, In, Sn, and Sb and d-transition metals V, Cr, Mn, Co, Ni, Zr, Nb, Mo, W, Cu, and Zn in hypoeutectic grey cast iron, and of rare-earth metals in hypereutectic cast iron was studied in order to gain information on the structure formation during solidification. (Metals Abstr.)

15243 MELTING AND PURIFICATION METHODS IN ELECTRON BEAM FURNACES. Pt. 1. Stephan, H. (Leybold-Heraeus G.m.b.H. und Co. K. G., Hanau (F. R. Germany)). Metall; 29: No. 7, 705-715(Jul 1975). (In German).

6 figs.; 18 tabs.; 29 refs.

After a general review on the market of electron beam furnaces, the melting methods and their variations are discussed in detail. The purification effects shown in a table allow a view on the main application. The losses of volatile alloy elements and the chances of compensation are specially discussed. (DE)

15244 NbTi SUPERCONDUCTORS OF HIGH CURRENT CARRIER CAPACITY. Willbrand, J.; Ebeling, R. (Krupp (Friedr.) G.m.b.H., Essen (F. R. Germany). Forschungsinstitut). Metall; 29: No. 7, 677-680(Jul 1975). (In German).

10 figs.; 15 refs.

Due to detailed investigations into the course of deformation and heat treatment in the manufacture of Cu stabilized NbTi superconductors, a high critical current density could be obtained. The investigations were firstly performed on mononuclear conductors due to their small expenditure. It was necessary to investigate the relative change of current carrier capacity for a different number of heat treatments and for different end deformations and intermediate deformations. These results were then transferred to multinuclear conductors and led to critical current densities of 2.6×10^5 A/cm^2 long sample value. The mentioned value could also be obtained in a solenoid (bore diameter 25 mm, wire length 1,600 m). The values are exceeded for shorter test wires. Besides round wires, conductors with square diameter and fully transposed conductors can be fabricated for different applications. (DE)

15245 PROBLEMS IN PLATE-WELDING IN NUCLEAR PLANTS. de Jong, K. H. Tech. Ueberwach.; 16: No. 3, 81-84(Mar 1975). (In German).

4 figs.; 12 refs.

The cracks observed a few years ago in the heat input zone of plate weldings in nuclear plants have led to detailed investigations which are reported on in the 2nd International Colloquium Welding in Nuclear Technology. The following report is limited to the studies dealing with the crack formation in the heat input zone of pressure vessel construction steels and with the interaction between the plating material and the basic material. (DE)

15246 ON THE ELECTROLYTIC CRYSTALLIZATION OF CADMIUM AND ZINC FROM ACID SOLUTIONS. Hedrich, H. D.; Raub, E. (Forschungsinstitut fuer Edelmetalle und Metallchemie, Schwaebisch Gmuend (F. R Germany)). Metall; 29: No. 6, 573-576(Jun 1975). (In German).

11 figs.; 1 tab.; 5 refs.

Zinc and cadmium can be precipitated from acidic sulphate electrolytes without addition of an inhibitor in compact form but only as coarse and rough crystals. Both metals exhibit a very different behavior with electrolysis which is due to the greater tendency of the zinc sulphate to hydrolyze and the amphoteric character of the zinc hydroxide. Anodic dissociation, especially the cathodic precipitation of the zinc, is not inhibited by zinc hydroxide. Rathermore, a distinct depolarization can be seen. Anodic dissociation and cathodic precipitation of cadmium are inhibited by the presence of cadmium hydroxide arising from hydrolysis at corresponding pH-number: the polarization increases. The electrocrystallization of both hexagonally most densely packed crystallized metals takes place at the same electrolysis conditions with the occurrence of different textures. The determining step for the discharge for the zinc precipitation obviously surpasses the zinc hydroxide at a sufficiently high pH. (DE)

15247 ION IMPLANTATION. A Powerful Technique for the Production of Metastable Superconducting Alloys. Heim, G. (Karlsruhe Univ. (TH) (F. R. Germany). Physikalisches Inst.); Stritzker, B. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Festkoerperforschung). Appl. Phys.; 7: No. 4, 239-248(Aug 1975).

6 figs.; 2 tabs.; 55 refs.

Ion implantation at liquid helium temperatures is a new method of producing metastable alloys. The special features of this alloying technique are illustrated by two selected examples of dilute and concentrated alloys, respectively. Superconductors containing small amounts of paramagnetic (3d)-impurities such as HgMn, PbMn, and SnMn exhibit strong pair breaking effects. In the case of SnMn the Kondo effect is observed. Concentrated alloys of Pd and Pd-noble metal alloys with hydrogen (deuterium) are only superconducting in a very high concentration range, being unstable at room temperature. Such concentrations can be achieved by ion implantation at liquid He-temperatures. The superconducting transition temperature can thus be raised to a maximum value of 16.6 K in a $H/Pd_{0.55}Cu_{0.45}$ approximately equal to 0.7 alloy. (DE)

15248 PREPARATION OF TANTALUM-BASED ALLOYS BY A UNIQUE CVD PROCESS. Bryant, W. A. (Westinghouse Astronuclear Labs., Pittsburgh); Meier, G. H. pp 161-177 of Chemical Vapor Deposition. Blocher, J. M. Jr.; Hintermann, H. E.; Hall, L. H. (eds.). Princeton, NJ; The Electrochemical Society, Inc. (1975).

From 5th international conference on chemistry vapor deposition; Burkinghamshire, UK (21 Sep 1975). See CONF-750991-.

One of the greatest problems associated with the formation of alloys by CVD is the achievement of compositional uniformity. In a typical deposition apparatus, wherein reactant gases are made to flow over the substrate in a continuous manner, this nonuniformity is inherent for two reasons. The composition of the gas stream changes as a function of its distance of travel over the substrate and, inevitably, one of the reactant compounds is more easily reduced than the other(s). This problem was overcome by the development of a process termed "pulsing." In it reactant gases are periodically injected into a previously evacuated reaction chamber where they cover the substrate almost instantaneously. By this technique, gas composition at any point in time is not dependent upon distance along the substrate. Formation of alternating layers of the alloy components and subsequent homogenization allows the formation of an alloy of uniform composition with the composition being determined by the duration and relative number of the various cycles. This technique has been utilized to produce dense alloys with the composition Ta–10 wt percent W by depositing alternating layers of Ta and W by the hydrogen reduction of $TaCl_5$ and WCl_6. The alloys were uniform in thickness and composition over lengths in excess of 20 cm and the target composition was attained. A similar attempt to deposit a Ta–8 wt percent W–2 wt percent Hf alloy was unsuccessful because of the difficulty in reducing $HfCl_4$ at temperatures below those at which gas phase nucleation of Ta and W occurred (1200 and 1175°C respectively). 7 fig. (auth)

15249 THERMAL DECOMPOSITION OF GASEOUS METAL FLUORIDES ON METALS. Dejachy, G. (CEN, Saclay, France); Gillardeau, J.; Rigny, P.; Oudar, J. pp 178-189 of Chemical Vapor Deposition. Blocher, J. M. Jr.; Hintermann, H. E.; Hall, L. H. (eds.). Princeton, NJ; The Electrochemical Society, Inc. (1975).

From 5th international conference on chemistry vapor deposition; Burkinghamshire, UK (21 Sep 1975). See CONF-750991-.

The growth of copper crystals on copper, by thermal decomposition of CuF_2, has been studied previously. It has been observed that, at a given temperature, the deposition rate reaches a maximum value which seems to be controlled only by the desorption of fluorine from a complete monolayer. Recent results concerning the thermal decomposition of TiF_4 on Ti and FeF_2 on Fe confirm this mechanism and give a measure of the heat of desorption of fluorine. The deposition rate can be generally improved if one uses the thermal decomposition of subfluorides. A method was based on sub-fluoride preparation in situ near the substrate. According to this new method, the formation of the sub-fluoride and its thermal decomposition occur simultaneously. This process is very suitable for the deposition of refractory metals at relatively low temperatures. Some examples are given, concerning mainly the decomposition of WF_6. Generally, in comparison with other halides, it seems that the thermal decomposition of fluorides is preferable for obtaining very high quality deposits, provided the technology necessary for fluorine chemistry is available. (auth)

15250 COMPARATIVE STUDY OF TANTALUM DEPOSITION BY CHEMICAL VAPOR DEPOSITION AND ELECTRON BEAM VACUUM EVAPORATION. Spitz, J.; Chevallier, J. (CEN, Grenoble, France). pp 204-213 of Chemical Vapor Deposition. Blocher, J. M. Jr.; Hintermann, H. E.; Hall, L. H. (eds.). Princeton, NJ; The Electrochemical Society, Inc. (1975).

From 5th international conference on chemistry vapor deposition; Burkinghamshire, UK (21 Sep 1975). See CONF-750991-.

Coating of steel parts with tantalum was carried out by the two following methods: (1) chemical vapor deposition by hydrogen reduction of $TaCl_5$ (1100°C, 200 mmHg, $H_2/TaCl_5 = 10$) and (2) electron beam vacuum evaporation in which case Ta was first condensed by ion plating ($p_{Ar} = 5 \times 10^{-3}$ up to 2×10^{-2}mmHg, $U_c = -3$ to -4 KV and $J_c = 0.2$ to 1 mA cm^{-2}) in order to ensure a good adhesion between deposit and substrate; then by vacuum condensation (substrate temperature = 300 to 650°C) to ensure that the coating was impervious to HCl and H_2SO_4 acids. The advantages and disadvantages of each method are discussed. (auth)

15251 [110] PREFERENTIALLY ORIENTED CVD TUNGSTEN. Shroff, A. M.; Delval, G.; Lebreton, J. (Thomson-CSF, Paris). pp 351-364 of Chemical Vapor Deposition. Blocher, J. M. Jr.; Hintermann, H. E.; Hall, L. H. (eds.). Princeton, NJ; The Electrochemical Society, Inc. (1975).

From 5th international conference on chemistry vapor deposition; Burkinghamshire, UK (21 Sep 1975). See CONF-750991-.

When WF_6 is used, the most frequent preferred crystal orientation is [100], no matter how the deposition parameters are varied. When WCl_6 is used, the orientation is again usually [100], but the [110] direction can be obtained for certain deposition parameters. A model is presented to explain the results. (DLC)

15252 PREPARATION OF CVD MOLYBDENUM, TANTALUM, AND TANTALUM OXIDE LAYERS. Hieber, K.; Stolz, M. (Siemens A. G., Muenchen, Ger.). pp 436-449 of Chemical Vapor Deposition. Blocher, J. M. Jr.; Hintermann, H. E.; Hall, L. H. (eds.). Princeton, NJ; The Electrochemical Society, Inc. (1975).

From 5th international conference on chemistry vapor deposition; Burkinghamshire, UK (21 Sep 1975). See CONF-750991-.

Using 2 $MoCl_5$ + 5 H_2 2 Mo + 10 HCl at 600 to 1350°C, adherent Mo films (thickness 8 μm) were deposited on Ni/Fe substrates. Parameters influencing the surface structure were the partial pressure of $MoCl_5$, flow rate, and pressure of the hydrogen carrier gas. In order to produce pure Ta films as a corrosion inhibiting layer, the contamination of the material was controlled by microprobe investigations. The main impurities were carbon and iron. Choosing a substrate temperature of 900 to 950°C, the impurity concentration in the CVD Ta was less than 1%. Doping the hydrogen carrier gas with oxygen produced Ta-oxide films whose electrical properties could be influenced over a wide range. At an oxygen partial pressure of 2 to 10 N/m^2 (hydrogen pressure 5×10^4 N/m^2, substrate temperature 800°C) β-Ta_2O_5 films containing an amorphous phase with metallic conductivity were deposited. The resistivity of these films is 10^{-2} to $10^{-1}\Omega$ cm and its temperature coefficient varies between +100 and −500 ppM/deg. Their electrical properties indicate possible use as thin-film resistors. (10 fig) (DLC)

15253 PREPARATION OF HIGH T_c Nb_3Ge SUPERCONDUCTORS BY CHEMICAL VAPOR DEPOSITION. Newkirk, L. R.; Valencia, F. A.; Wallace, T. C. (Los Alamos Scientific Lab., NM). pp 704-712 of Chemical Vapor Deposition. Blocher, J. M. Jr.; Hintermann, H. E.; Hall, L. H. (eds.). Princeton, NJ; The Electrochemical Society, Inc. (1975).

From 5th international conference on chemistry vapor deposition; Burkinghamshire, UK (21 Sep 1975). See CONF-750991-.

Bulk layers of Nb_3Ge were deposited on copper substrates at 900°C by hydrogen reduction of the chlorides of niobium and germanium with resistive T_c's as high as 22.5°K and current densities up to 1.8×10^6 amp-cm^{-2} at 13.8°K. The paper provides a detailed description of the coating process as well as empirical correlations between deposition parameters and T_c. Quantitative chlorination of Nb was found to be possible at $T \approx 250$°C and for $T > 900$°C extending the range of delivery rates below those obtainable by powder feeding of $NbCl_5$. Coatings in the range of 10-60 μm thick have been produced with a typical deposition efficiency of 50-65% for mass flow rates of the order of 1 g of salt per minute. The superconducting transition temperature was correlated with a parameter of the form mole ratio × dilution × Reynolds number$^{0.22}$, where mole ratio is defined by moles Nb : moles (Ge + 0) in the gas stream, and dilution by moles gas: moles salt. In addition, the relationship between mole ratio and dilution which determines the phase produced (Nb_3Ge or Nb_5Ge_3) is defined over the region of major interest. Lattice spacings are presented over a range of T_c's, and microstructure and substrate adherence are discussed. (auth)

15254 MICROSPHERICAL LASER TARGETS BY CVD. McCreary, W. J. (Los Alamos Scientific Lab. NM). pp 714-725 of Chemical Vapor Deposition. Blocher, J. M. Jr.; Hintermann, H. E.; Hall, L. H. (eds.). Princeton, NJ; The Electrochemical Society, Inc. (1975).

From 5th international conference on chemistry vapor deposition; Burkinghamshire, UK (21 Sep 1975). See CONF-750991-.

Apparatus and process conditions are described for the chemical vapor deposition (CVD) of thin (0.5 to 5 μm) metal shells onto hollow microspheres to alter their physical characteristics and to increase their strength. The metals, including Ni, Mo, Re, and Mo-Re, are deposited from the pyrolysis of their carbonyls onto the substrates in small volume (0.2 to 10 ml) fluid beds at reduced pressures, usually from 50 to 400 Torr (6.6 kPa to 53.3 kPa). The substrates, ranging in size from ~40 μm to 200 μm, have very low mass and high surface to mass ratios and do not form conventional fluid beds. The procedures for coating these substrates have been modified to permit coating and recovering a few (~20 particles) very carefully selected microspheres. Techniques developed to form freestanding thin wall metal microspheres by leaching soluble substrates through porous CVD shells which are then overcoated to close the pores and to increase the wall thickness are discussed. Some of the destructive and nondestructive tests used to evaluate the coated and gas-filled microspheres are described. Some of the CVD Mo/Re coatings proved to be superconducting. (15 fig) (auth)

15255 CHEMICAL VAPOR DEPOSITION OF "AMORPHOUS" BORON ON MASSIVE SUBSTRATE. Vandenbulcke, L.; Vuillard, G. (CNRS-ORLEANS, Cedex, France). pp 763-776 of Chemical Vapor Deposition. Blocher, J. M. Jr.; Hintermann, H. E.; Hall, L. H. (eds.). Princeton, NJ; The Electrochemical Society, Inc. (1975).

From 5th international conference on chemistry vapor deposition; Burkinghamshire, UK (21 Sep 1975). See CONF-750991-.

Compact coatings of "amorphous" boron were deposited on a smooth surface of a substrate such as graphite, refractory metals, iron, and stainless steel using the reduction of boron trichloride by hydrogen. With a constant surface temperature, and a low deposition efficiency, a constant thickness is obtained if transport limitations are avoided in all points of the surface. Extension of the results is proposed for the deposition on larger surfaces and complex shaped substrates. The rate of deposition was studied at temperatures ranging from 950 to 1200°C. The apparent activation energy is found equal to 31.4 kcal/mole. Adherence and absence of cracks are a function of the specific nature of the substrates. The most satisfactory coatings were obtained on graphite and on refractory metals of group Vb, iron and stainless steel. On iron and stainless steel, a diffusion barrier was first deposited by pack cementation, which avoids the transport of the metals and slows down the boron diffusion. Boron morphology regularity is shown to be a function of nucleation. (auth)

15256 EROSION RESISTANT TUNGSTEN COATINGS FOR ROCKET NOZZLE APPLICATIONS. Sherwood, P. J. (Ministry of Defence, Buckinghamshire, Eng.); Hayman, C.; Bowry, A. pp 801-814 of Chemical Vapor Deposition. Blocher, J. M. Jr.; Hintermann, H. E.; Hall, L. H. (eds.). Princeton, NJ; The Electrochemical Society, Inc. (1975).

From 5th international conference on chemistry vapor deposition; Burkinghamshire, UK (21 Sep 1975). See CONF-750991-.

An account is given of the results of work to develop CVD tungsten coated, graphite rocket nozzle inserts, by deposition from the fluoride and the chloride. It has been shown that the "chloride" route, which hitherto has not been fully evaluated for this purpose, is equally capable of producing heavy tungsten coatings of high quality. A comparison is made of the quality and performance of products obtained by the two methods. (auth)

15257 INFLUENCE OF $MoCl_5$ ON THE CHEMICAL VAPOR DEPOSITION OF TUNGSTEN FROM WF_6. Seymour, W. C.; Byrne, J. G. (Univ. of Utah, Salt Lake City). pp 815-828 of Chemical Vapor Deposition. Blocher, J. M. Jr.; Hintermann, H. E.; Hall, L. H. (eds.). Princeton, NJ; The Electrochemical Society, Inc. (1975).

From 5th international conference on chemistry vapor deposition; Burkinghamshire, UK (21 Sep 1975). See CONF-750991-.

Higher tungsten deposition rates are obtained at 600°C when the $MoCl_5$ flow rate is 5% that of WF_6 in the reactant gas mixture than are obtained in the conventional H_2 reduction of WF_6. The rates are higher than the conventional process gives even at 800°C. At 600°C the high growth rate is essentially independent of the amount of $MoCl_5$ present in the reactant gas mixture from 1-10%. At intervals of 50°C from 600°C up to 800°C, increasing the relative amounts of $MoCl_5$ tends to generally decrease tungsten deposition rates. It should be noted that the molybdenum does not become incorporated in the deposit. Growth surface morphologies, observed with the scanning electron microscope, were quite different from those obtained by the conventional WF_6 + H_2 reaction. One can obtain three-sided pyramids (rather than four-sided), mixtures of three- and four-sided pyramids, surfaces with no faceting at all, and a surface largely composed of tungsten spheres. These morphologies are discussed in terms of possible growth rates and mechanisms. Metallography revealed that the columnar structure of conventional CVD tungsten is broken up by the $MoCl_5$ influence. Tensile tests revealed a fracture strength maximum for specimens made at 750°C for each of runs with 1, 2.5, and 5.0% $MoCl_5$ present in the feed gas. Similar runs made with no $MoCl_5$ present yielded CVD tungsten whose fracture strength was independent of deposition temperature and considerably lower in magnitude. (auth)

Properties, Structure, and Phase Studies

Refer also to abstracts 14791, 14794, 15169, 15199, 15244, 15332, 15892, 15894-15896, 16499, and 16528.

15258 (AD/A-005206) THERMAL EMISSION PROPERTIES OF RARE EARTH METALS. Kultashev, O. K.; Rozhkov, S. E. 9 Jul 1974. Trans. of Mono. Redkozemel. Metally i Spalavy, Moscow, 1971, p 57-59. (FSTC-HT-23-761-74). 8p. NTIS $3.25.

The work functions of a number of rare earth metals were calculated from data of experimental sputtering of rare earth metals of high purity onto a tungsten or rhenium substrate through an anode slit in a vacuum tube. The work functions appear to change uniformly, with the exception of divalent europium and, in the yttrium subgroup, lutetium. It is proposed that the total change in ϕ from lanthanum to lutetium is determined to a certain extent by the lanthanide compression. An additional factor is thought to be the reactions of free electrons with the f-shells, especially the resonance reactions. (GRA)

15259 (BNL-tr-618) PINNING CENTERS IN POLYCRYSTALLINE Nb_3-SN FILMS. Bashkirov, Yu. A.; Vinogradov, V. M.; Darinskaya, E. V.; Kiseleva, K. V.; Kurganov, G. B.; Nikitina, G. T.; Rozhanskii, V. N. Translated by S. J. Amoretty from Fiz. Met. Metalloved.; 37: No. 3, 517-524(1975). 18p. Dep. NTIS $4.50.

The possibility of increasing the critical current density in polycrystalline Nb_3Sn films by incorporation of defects and inhomogeneities was investigated. It was found that if the Nb_3Sn composition departs significantly from stoichiometry (approximately 3 at. percent), it forms pinning centers because of the presence of the intrinsic defects (clustering of vacancies in the tin sublattice) of larger than optimum size. As a result, critical current densities of less than or equal to 1.6×10^5 A/cm^2 are produced in a 40-kOe field. Removal of tin from the Nb_3Sn lattice by heat treatment initially increases the size of the intrinsic defects, followed by precipitation of crystals of the new nonsuperconducting phases serving as secondary pinning centers. Since precipitation occurs in the form of local clustering, the crystals rapidly increase in size, which decreases their importance as pinning centers while maintaining their low concentration. The critical

current densities produced by the presence of these centers are less than or equal to 2.5 x 10^5 A/cm^2 in a 40-kOe field. The importance of pinning in the intrinsic defects can be determined when polycrystalline Nb_3Sn films whose deviation from stoichiometry can be controlled in the entire range of the Nb_3Sn phase. (auth)

15260 (CONF-751209-6) MAGNETIC STUDIES OF ACTINIDES: EVIDENCE FOR LOCALIZED MAGNETISM. Lander, G. H. (Argonne National Lab., Ill. (USA)). 1975. 21p. Dep. NTIS $4.50.

From 21st annual conference on magnetism and magnetic materials; Philadelphia, Pennsylvania, USA (9 Dec 1975).

The position of the 5f elements in the periodic table suggests that the electronic properties of these elements (and their compounds) will resemble those of the lanthanide series. However, the extended nature of the 5f wave functions leads to fundamental differences between 4f and 5f systems. Evidence for localized magnetism is reviewed. Results of magnetization, Moessbauer, neutron, and low-temperature x-ray experiments on Np, Pu, and Am compounds are used to illustrate both the similarities to and differences from lanthanide magnetism. A determination of the ground-state 5f electron wave functions is, in principle, possible by measuring the neutron magnetic cross section. The interpretation of such experiments on UO_2, USb, and PuP requires a knowledge of the radial extent of the 5f electrons, which is obtained from relativistic Dirac-Fock calculations, and the use of the tensor-operator formalism to treat the spin-orbit interaction. This interaction in Pu^{3+} (a $5f^6$ configuration) results in a magnetic form factor that initially increases with increasing scattering angle. For USb the experimental magnetic scattering is used to determine the ground-state wave function of the U^{3+} ion. In addition the temperature dependence of the quadrupole moment in USb has been measured and yields information both on the size of the crystal-field and exchange interactions, and on the interplay between them. (auth)

15261 (COO-1676-38) EFFECT OF ANODIC OXIDE FILMS ON LOW TEMPERATURE MECHANICAL BEHAVIOR OF NIOBIUM SINGLE CRYSTALS. Sethi, V. K.; Gibala, R. (Case Western Reserve Univ., Cleveland, Ohio (USA). Dept. of Metallurgy and Materials Science). 31 Oct 1975. Contract AT(11-1)-1676. 10p. (CONF-750999-1). Dep. NTIS $3.50.

From meeting on surface effects in crystal plasticity; Hohegeiss, F.R. Germany (5 Sep 1975).

The effect of thin (less than or equal to 1500 A) anodic oxide films on the mechanical behavior of single crystals of niobium at low temperatures (T less than or equal to 0.15 T/sub M/) was investigated. Oxide films affect mechanical behavior in two ways: the yield stress is reduced and the stress-strain curves are serrated over an appreciable range of strains. When oxide-coated specimens are also prestrained into stage I at 300°K, the serrations observed at low temperatures disappear, the flow stress is further reduced, the ductility is increased, and a three-stage work hardening behavior occurs. A model involving generation and motion of nonscrew dislocations from the oxide-metal interface is used to explain the results. (auth)

15262 (ERDA-tr-86) REPORTS OF THE NUCLEAR RESEARCH CENTER, KARLSRUHE, 7th Annual Publication. (Kernforschungszentrum Karlsruhe (F. R. Germany)). Jan 1975. Translated from German Report. 82p. Dep. NTIS $6.00.

Separate abstracts were prepared for each of the 8 papers included.

15263 (ERDA-tr-86, pp 32-39) CRITICAL CURRENT LOAD CAPACITY OF NbTi SUPERCONDUCTORS AND THEIR ANGLE DEPENDENCE. Juengst, K. P. (Institute for Experimental Nuclear Physics, Karlsruhe, Ger.). Jan 1975. Translated from German report.

In reports of the Nuclear Research Center, Karlsruhe. 7th annual publication.

The fabrication and performance of superconducting NbTi wires are examined. Discussions are included on conductor construction, critical current relations with shielding currents, short volume pinning force, and critical current angle dependence. (JRD)

15264 (ERDA-tr-86, pp 49-57) HIGHEST GRADE ALUMINUM AS CONDUCTING MATERIAL FOR CRYOMAGNETS. Schauer, W. (Institute for Experimental Nuclear Physics, Karlsruhe, Ger.). Jan 1975. Translated from German report.

In reports of the Nuclear Research Center, Karlsruhe. 7th annual publication.

Results of studies on the cryogenic resistance behavior of high-grade Al are presented. Discussions and data are included on production of high-purity Al, determination of electric conductivity, and magnetoresistance. (JRD)

15265 (JINR-E14-9206) NEUTRON SCATTERING INVESTIGATIONS OF FeMnNi(Be) ALLOYS. Feldmann, K.; Hennig, K.; Matz, W.; Mueller, M.; Schreiber, J.; Weiss, L. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 13p. Dep. NTIS (US Sales Only) $4.50.

The diffraction data show that the investigated Be-containing Fe Mn Ni-alloys consist of the disordered fcc γ-phase and the Ni Be-phase, where the concentration of the latter depends on the annealing temperature and the degree of cold-working. Inelastic neutron scattering experiments show localized modes due to Be atoms. Furthermore, peaks from inelastic magnetic scattering were found. They are explained by acoustic and optical antiferromagnons, which can be understood in the framework of the modified Zener model. (auth)

15266 (MLM-2277) INTERNAL FRICTION IN URANIUM. Selle, J. E. (Mound Lab., Miamisburg, Ohio (USA)). 20 Nov 1975. Contract E-33-1-Gen-53. 27p. Dep. NTIS $4.00.

Results are presented of studies conducted to relate internal friction measurements in U to allotropic transformations. It was found that several internal friction peaks occur in alpha-uranium whose magnitude changed drastically after annealing in the beta phase. All of the allotropic transformations in uranium are diffusional in nature under slow heating and cooling conditions. Creep at regions of high stress concentration appears to be responsible for high temperature internal friction in alpha-uranium. The activation energy for grain boundary relaxation in alpha-uranium was found to be 65.1 +- 4 kcal/mole. Impurity atoms interfere with the basic mechanism for grain boundary relaxation resulting in a distribution in activation energies. A considerable distribution in ln tau_0 was also found which is a measure of the distribution in local order and in the Debye frequency around a grain boundary. (auth)

15267 (NRL-Report-7936) EFFECT OF SPECIMEN THICKNESS ON FATIGUE CRACK-GROWTH RATE IN 5Ni–Cr–Mo–V STEEL: COMPARISON OF HEAT-TREATED AND STRESS-RELIEVED SPECIMENS. Sullivan, A. M.; Crooker, T. W. (Naval Research Lab., Washington, D. C. (USA)). 9 Dec 1975. 16p. Office of Naval Research, Arlington, VA.

Ship structural design now incorporates the weight-saving advantage of high-strength alloys by reducing the thickness requirements of load-bearing members. For fail-safe applications of thin-section material (less than 0.50 in. thick) in high-performance ship structures, quantitative information concerning the fatigue crack-growth rate (FCGR) in both ambient air and the marine environment is highly important. The diverse conclusions of presently available information concerning the effect of material thickness on FCGR provide little engineering guidance for the design of thin-section naval structures. Results of studies of FCGR on a 5Ni–Cr–Mo–V steel tested in three thicknesses indicate that internal residual stresses may have a retardation effect on FCGR in this material. When tested after stress relief, although crack growth is accelerated, it is essentially the same for all thicknesses. (auth)

15268 (NRL-Report-7941) CRACK-LENGTH DETERMINATION FOR THE COMPACT TENSION SPECIMEN USING A CRACK-OPENING-DISPLACEMENT CALIBRATION: COMPARISON OF COD MEASURED GRAPHICALLY AND FROM THE GAGE OUTPUT. Sullivan, A. M. (Naval Research Lab., Washington, D. C. (USA)). 10 Dec 1975. 18p. Office of Naval Research, Arlington, VA.

To implement the increasing trend toward automated testing procedures, crack-length measurement during fatigue crack-growth-rate testing was determined using a COD gage technique. Data were analyzed both graphically and using the gage output measured in millivolts. To compensate for nonlinearity in the load-vs-COD traces, it was found necessary to sample differences in the load millivolt readings to produce smooth da/dN-vs-DELTA K curves agreeing with those determined from graphical analysis of crack length. (auth)

15269 (ORNL-TM-4993) INTERIM REPORT ON THE CONTINUOUS CYCLING ELEVATED-TEMPERATURE FATIGUE AND SUBCRITICAL CRACK GROWTH BEHAVIOR OF 2 1/4 Cr–1 Mo STEEL. Brinkman, C. R.; Booker, M. K.; Strizak, J. P.; Corwin, W. R.; Frazier, J. L.; Leitnaker, J. M. (Oak Ridge National Lab., Tenn. (USA)). Dec 1975. Contract W-7405-eng-26. 91p. AT.

Results are reported for load- and strain-controlled fatigue tests conducted from room temperature to 1000°F with comparisons of other data to 1100°F. Cyclic hardening and softening characteristics for several heats of 2¼ Cr–1 Mo steel in the isothermally annealed condition are discussed. The data measured in this effort are compared with data available from the literature, and from the compilations possible ASME design fatigue curves

are prepared covering continuous high- and low-cycle behavior from room temperature to 1100°F. Equations for these design curves are given. Limited information concerning tensile behavior, metallographic examination, heat-to-heat variations, and strain aging effects are also given. Results of limited subcritical crack growth tests conducted to 1100°F (593°C) at several stress ratios and frequencies are reported. 51 figures, 30 tables. (auth)

15270 (ORNL-TM-5170) QUARTERLY PROGRESS REPORT ON THE HEAVY-SECTION STEEL TECHNOLOGY PROGRAM FOR JULY–SEPTEMBER 1975. Whitman, G. D. (Oak Ridge National Lab., Tenn. (USA)). Jan 1976. Contract W-7405-eng-26. 89p. Dep. NTIS $6.50.

Activities in research programs are reported on pressure vessel fracture properties, effects of reactor coolant water on reactor vessel cracking, pressure vessel load testing, thermal shock, and reheat cracking. (JRD)

15271 (RD/B/N-3383) CREEP AND FATIGUE OF AISI 316 STAINLESS STEEL FOLLOWING EXPOSURE TO LOW (~0.10) CARBON ACTIVITY SODIUM. Carnock, W.; Marshall, P. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Apr 1975. 26p. Dep. NTIS (US Sales Only) $4.50.

Specimens of AISI 316 stainless steel were subjected to fatigue and creep testing after exposure to sodium of carbon activity ~0.1 at 633°C for 800 h. The gradient of predominantly grain boundary carburization extended to the center of the 0.75 mm thick specimens and had the effect of marginally reducing the room temperature fatigue endurance and increasing the elevated temperature (633°C) fatigue endurance. Current models of fatigue behavior indicate that these effects may be attributed respectively to a decrease in cold ductility and an increase in hot tensile strength. The creep strength at 600°C was markedly increased at all stresses within the range 180 to 270 N/mm^2 and the creep ducitility was marginally reduced. At low stresses, strength increased with time as a result of carbide redistribution while the higher stress strength increases are thought to originate from a dynamic strain aging effect involving a chromium-carbon-dislocation interaction. (auth)

15272 (SAND--75-5779) NET ANISOTROPY AND FERROMAGNETIC RESONANCE FREQUENCY OF AN AMORPHOUS FERROMAGNET. Richards, P. M. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1975. 6p. (CONF-751209--1). Dep. NTIS $4.50.

From 21st annual conference on magnetism and magnetic materials; Philadelphia, Pennsylvania, USA (9 Dec 1975).

The net anisotropy constants and the ferromagnetic resonance (FMR) frequency are calculated in a model of amorphous ferromagnetism for which the axes of strong local uniaxial anisotropy are nearly randomly oriented throughout the sample, and, consequently, the equilibrium directions of local magnetization are nonuniform. A slight preferential ordering produces net anisotropy perpendicular to the plane of a thin film sample as appropriate to sputtered Gd–Co films. The net anisotropy is a maximum for a given H/sub A/ near H/sub A/ H/sub E/ equals 1,5, where H/sub A/ and H/sub E/ are the local anisotropy and exchange fields, and at H/sub A//H/sub E/ equals 10 it is less than its value for H/sub A//H/sub E/ yields 0, corresponding to uniform magnetization. The FMR resonance frequency omega would contain a term of the order of H^2/sub A//H/sub E/, which can be comparable to the net anisotropy field (H/sub A/), if the magnetization were uniform, but this term cancels out if proper account is taken of the nonuniformity. As a result, omega is the same as would be computed for a uniform anisotropy field (H/sub A/). (auth)

15273 (SAND-75-6009) INFLUENCE OF AGGRESSIVE MEDIA ON THE MECHANICAL BEHAVIOR OF THE URANIUM–0.20 WT PERCENT VANADIUM ALLOY—THE ROLE OF HYDROGEN EMBRITTLEMENT. Arnould-Laurent, R. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Nov 1975. Translation of French thesis submitted to Paris Univ., Orsay, France. 169p. Dep. NTIS $6.75.

Thesis.

The tests comprised tensile tests under constant load or up to the fracture point using cylindrical or flat, trapezoidal test pieces, tests in which disks were ruptured under gaseous pressure, and tenacity tests. The alloy was found to be sensitive to: (1) intrinsic brittleness (I.B.) due to dissolved residual hydrogen from the preparation stage. This manifested itself mainly by cracking at an elongation threshold of about 3 percent. (2) Cracking due to stress corrosion (S.C.C.) in the true sense, which is made possible under certain conditions by an imperfect passivation of the metal surface. The process is initiated either by the appearance of microcracks which appear at the surface, or by corrosion pits. Cracking then progresses by alternate stages of localized chemical reactions and embrittlement due to the hydrogen liberated within the crack. (3) Generalized corrosion accelerated by the stress (S.A.C.), whose microscopic appearance is similar to that observed with corrosion under gaseous hydrogen. I.B. is determined in dry argon, while deformation up to fracture in aqueous solutions (pH between 2 and 14) or after exposure to a chlorinated solvent results in I.B. + S.C.C., with the S.C.C. being predominant. Below pH 2 there is no stress corrosion. Stress rupture tests in moist air at 80 and 100°C measure I.B. + S.C.C. under high stress, giving rise to short lifetimes. I.B. + S.C.C. + S.A.C., with S.A.C. predominant, occurs under lower stresses that give long lifetimes. Stress rupture tests measure at 20 and 60°C I.B. + S.C.C. with I.B. predominant. Under high stresses (short lifetimes) the magnitude of the S.C.C. component increases as the temperature increases. The most serious effects are those of S.A.C. at 80 and 100°C, and of I.B. at all temperatures. The lifetime curves do not suggest the existence of any rupture immunity threshold. Thus, the way this alloy behaves can only be changed by an effective reduction in the quantity of residual hydrogen present, or by coatings that will in no case allow the ingress of hydrogen. 62 fig, 82 references, 15 tables. (DLC)

15274 (UCRL-Trans-10735) THEORETICAL CALCULATION OF THE SOLUBILITY OF HYDROGEN IN SOLID AND LIQUID METALS. Filippov, E. S. Translated from Izv. Vyssh. Uchebn. Zaved., Chern. Metall.; No. 7, 122-128(1973). 13p. Dep. NTIS $4.00.

The solubility of H in solid and liquid metals was investigated in a wide range of temperatures, starting from first principles–lattice data (coordination number and atomic radii). The model of spheres of interaction was applied to the solubility of hydrogen by a method developed for the solubility of oxygen in equilibrium with a deoxidizing agent. In the polycrystalline representation of a liquid metal the sum of the solubilities in clusters (main volume) and in the disordered zone are considered. It is therefore easy to take DELTA V/sub m,p,/ as the part of the volume relating to the disordered zone (termed statistical packing (s,p,)), and V/sub s/ as the clusters. The results show that dissolution in s.p. microregions (if such exist) is difficult. Dissolution in vacancies and pores is not dissolution in microregions of the disordered zone, and the additional solubility increment associated with DELTA V/sub m.p./ does not relate to a direct increase of the disordered zone or s.p. microregions. The property of grain boundaries to condense appreciable quantities of material cannot be extended to disordered microregions of the liquid. (auth)

15275 (UCRL-Trans-10975) METALLURGICAL STUDY OF ELECTRON-BEAM WELDING OF THE ALLOY U–0.2 PERCENT V. Prunier, C.; Linard, M.; Guillaumin, J.; Giraud-Heraud, F. Translated from Mem. Sci. Rev. Metall.; 71: No. 7/8, 461-473 (1974). 27p. Dep. NTIS $5.00.

The effects of welding cycles on U–0.2 percent V alloys involving cooling at high rates from the beta and gamma phases were studied. The results indicate that the welding operation modifies the initial structure obtained by the heat treatment to refine the alpha grain. The weld is decomposed into three primary zones of different metallurgical nature with respect to the particular thermal cycles. Beta-hardenings are characterized by a single beta yields alpha transformation range. In contrast, depending on the cooling law, gamma-hardenings are manifested by one or more transformation anomalies which lead to complex alpha structures, one of which has a maximum hardness and a minimum ductility. (auth)

15276 (UCRL-Trans-10977) STUDY OF THE FORGEABILITY AND DEFORMATION RESISTANCE OF THE ALLOY U–0.2 PERCENT V BY TORSION TESTS BETWEEN 400 AND 800°C. Choquet, P.; Prunier, C. Translated from J. Nucl. Mater.; 57: 34-44(1975). 27p. Dep. NTIS $5.00.

The resistance to deformation and the deformation capacity of the alloy U 0.2 wt. percent V between 400 and 800°C for deformation rates between 10^{-2} s^{-1} and 3.6 s^{-1} were studied by hot torsion. In this temperature range, the alloy exhibits three distinct phases in succession: orthorhombic alpha, tetragonal beta, and body-centered cubic gamma, which behave differently. Two useful ranges were determined for the plastic working of the alloy U 0.2 wt. percent V: the alpha phase above 600°C and the gamma phase. By the theory of plasticity the equivalence between the hot-torsion results and hot-tension results was established and a first rolling pass was simulated. Tensile tests between 600 and 800°C and a rolling test at 600°C demonstrated the justification for the transition between torsion and other modes of deformation. A micrographic study of the structure of test pieces after fracture showed the existence of recrystallization in the alpha phase beginning at 600°C and in the gamma phase, which explains the good workability observed. (auth)

15277 WIGNER TRANSITION IN A MAGNETIC FIELD. Kleppmann, W. G.; Elliott, R. J. (Oxford Univ.). J. Phys., C (London); 8: No. 17, 2729-2736(7 Sep 1975).

Criteria for the stabilization of a condensed Wigner phase are re-examined for a low-density free-electron gas (jellium) in a uniform magnetic field. By a new calculation of the Coulomb energy, it is shown that below a critical density the lowest energy state has electrons in cigar-shaped charge distributions arranged on an elongated body-centered tetragonal lattice. Critical densities are computed as functions of magnetic-field strength for free electrons in astrophysical situations and for electrons of low effective mass in semiconductors. In the latter case, the results can be used to give a satisfactory interpretation of experimental results in heavily compensated InSb. (auth)

15278 FORMATION AND STABILITY OF THE Nb_3Sn PHASE [IN THE SYSTEM NIOBIUM–TIN]. Rutkowski, W.; Horubala, Z. Arch. Hutn.; 19: No. 3, 277-287(1975). (In German)

In order to explain differences in the literature data, the formation and stability of the Nb_3Sn phase in the Nb–Sn system were studied. Specimens were prepared by thermal diffusion, powder metallurgy, vacuum deposition, plasma spraying, and explosive cladding. The specimens were rolled and heat treated. The Nb_3Sn phase is stable at 4.2 to 2070°K, it can be obtained by thermal diffusion at 1170°K, and its composition varies within narrow limits. Mechanical treatment and impurities lower the superconductivity of the Nb_3Sn phase. (Metals Abstr.)

15279 INTEGRAL SODIUM LOOP SET. Dubsek, F.; Tomes, V.; Sobotka, J.; Konecny, A. Czech. Heavy Ind.; No. 11, 23-32 (1974).

Descriptions of a Na loop designed and produced for research into Na/Na, Na/air and water heat exchangers, and of the quick acting electromagnetic valves, and pumps incorporated are presented. The equipment has operated for 3000 h without mishaps, and is used for research into the development of fast reactors and for the training of operators. (Metals Abstr.)

15280 THE YIELD STRENGH-HOT HARDNESS RELATIONSHIP OF ZIRCALOY-4. Peggs, I. D.; Godin, D. P. (Whiteshell Nuclear Research Establishment, Pinawa, Manitoba, ROE ILO, Canada). J. Nucl. Mater.; 57: No. 2, 246-248(Aug 1975).

The determination of gap conductance between the fuel and sheath of a reactor fuel element requires a knowledge of the Meyer hardness (H) of the softer material, usually the sheath. High temperature hardness data on sheathing material are sparse so most analyses rely on a relationship between yield strength (Y) and hardness to derive H. It was decided to check the relationship for Zircaloy-4 at temperatures up to 873°K. (NL)

15281 HEAT CAPACITY OF TANTALUM AND TUNGSTEN AT HIGH TEMPERATURES. Korenkov, Yu. P.; Mints, R. G. (High-Temperature Inst., Moscow). High Temp. (USSR) (Engl. Transl.); 12: No. 5, 989-991(1974).

Translated from Teplofiz. Vys. Temp.; 12: No. 5, 1123-1125 (1974).

The high-temperature heat-capacity of these elements was calculated by the method or associated plane waves and approximated by the method of least squares using Piecewise–smooth functions. The calculations were made for the temperature range 500°K to the melting points of Ta and W. Results are presented graphically and discussed. (JRD)

15282 STRUCTURE AND ELASTIC CHARACTERISTICS OF ALLOYS OF THE Nb–Ti SYSTEM. Vasil'eva, E. V.; Gorbova, A. S.; Prokoshkin, D. A. (Moscow Higher Technical School). Metalloved. Term. Obrab. Met.; No. 3, 73-74(1975). (In Russian).

Results are presented of investigation on binary Nb–Ti alloys containing 5 to 60% by wt Nb of the effect of titanium on the yield point $\delta_{0.003}$, the modulus of normal elasticity and on the microhardness of niobium. The dependence of the yield point $\delta_{0.003}$ of samples of Nb–Ti alloys in the annealing temperature is analyzed by reference to a diagram. The yield point of all investigated alloys increases before recrystallization annealing. The maximum increase of the yield point is observed at 700°C. It comprises 55 kg/mm² on the alloy with 1% Ti and 94 kg/mm² on the alloy with 25% Ti. Tabulated $\delta_{0.003}$ values of binary Nb–Ti alloys show that their optimum Ti-concentration is 25%. The clearly expressed dependence of the modulus of normal elasticity on the annealing temperature indicates a considerable influence of structural changes. It is the custom to consider that the modulus of elasticity characterizes only the strength of the interatomic bond and does not depend on the structure of the metal. The alloying of Nb with Ti increases considerably the resistance to small plastic deformations; the best effect is attained on alloys with 25 to 30% Ti. (JPRS)

15283 THERMODYNAMIC ANALYSIS OF THE Zn–Pb–Cd SYSTEM AND INTERACTION STUDIES IN TERNARY LIQUID DILUTE SOLUTIONS. Moser, Z. Metall. Trans., B; 6B: 103-109(Mar 1975).

Dilute Zn solutions in the Zn--Pb--Cd system were investigated by an emf method with concentration cells to show the influence of variation in Pb and Cd concentrations on the Zn activity coefficients. Zinc concentrations were held in the mole fraction range 0.03 less than or equal to X/sub Zn/ less than or equal to 0.1 with measurements in the temperature range 714 less than T less than 877°K. The limiting values of Zn activity coefficients for other ternary systems previously investigated were analyzed using Krupkowski's method and the random solution model of Alcock and Richardson. Experimental data for epsilon$_i^2$ and epsilon$_i^3$ (where 1 equals Zn and 2, 3 are components of investigated ternaries) are compared also with the values obtained from limiting activity coefficients of the particular binary systems. (Metals Abstr.)

15284 DIFFUSION IN TRANSITION METALS AND ALLOYS. Srikrishnan, V.; Ficalora, P. J. (Syracuse Univ., NY). Metall. Trans., 6A: No. 11, 2095-2102(Nov 1975).

The activation energies for diffusion in transition metals are correlated against the localized d electron population. The d electron population is determined by the Engel-Brewer theory. A quasi-chemical model of a binary solid solution is used to determine the distribution of atoms and vacancies. This model can be used to determine the average number of bonds affected by the formation of a vacancy and the jumping of an atom into the vacancy. The activation energy is considered to consist of energies of vacancy formation and atom migration. The correlative curve and an empirical ratio are used to separate the activation energies into the above two parts. The results of the quasichemical model and the correlation are combined. The calculated activation energies of impurity atoms in pure metals and of self diffusion in binary alloys (Co–Ni, Fe–Ti, Fe–Cr, and Fe–V) are compared with experimental results. (auth)

15285 PRECIPITATION OF alpha-PHASE IN METASTABLE beta-PHASE Ti ALLOYS. Rhodes, C. G.; Williams, J. C. (Rockwell International, Thousand Oaks, CA). Metall. Trans., 6A: No. 11, 2103-2114(Nov 1975).

The isothermal decomposition of metastable beta-phase in Ti–14 wt percent Mo–6 wt percent Al and Ti–11.6 wt percent Mo alloys has been studied by electron microscopy. Two distinct types of alpha-phase are observed as decomposition products. Type 1 alpha obeys the well-known Burgers orientation with respect to the beta-phase matrix. Type 2 alpha, which is characterized by arced reflections in the electron diffraction patterns, does not obey the Burgers orientation relation, but rather can be described as being in a [10 anti 1 2] (10 anti 1 1) twin orientation with respect to Burgers orientation alpha. The Type 1 alpha forms initially at aging temperatures in the range of 400 to 650°C, and is replaced by Type 2 alpha after longer holding times at the aging temperature. The Type 1 alpha precipitates form as monolithic plates in the ternary alloy and as monolithic needles in the binary. The Type 2 precipitates in the ternary alloy occur as very fine, contiguous particles in a colony-like arrangement wherein the colony has a plate morphology. The Type 2 precipitates in the binary alloy form as a peripheral shell around the Type 1 needle. Two possible mechanisms describing the formation of Type 2 alpha from Type 1 alpha are considered. The first of these is mechanical twinning of Type 1 alpha plates, and the second is a nucleation and growth mechanism which is driven by a composition difference between Types 1 and 2. The former is concluded to be less likely than the latter. (auth)

15286 CALCULATION OF SUPERALLOY PHASE DIAGRAMS, III. Kaufman, L.; Nesor, H. (Manlabs, Inc., Cambridge, MA). Metall. Trans., 6A: No. 11, 2115-2122(Nov 1975).

Previously computed descriptions of binary systems have been employed to calculate isothermal sections in the Ni–Nb–W, Nb–Cr–Ti, Cr–Ti–Fe, and Nb–Ni–Al systems which compare favorably with limited experimental data. Explicit descriptions of the Co–Mo, Co–W, Co–Ti, Co–Nb, Co–Al, and Co–Cr systems have been developed in line with lattice stability, thermochemical and phase diagram data to permit calculation of cobalt-base superalloy systems. (auth)

15287 CALCULATION OF SUPERALLOY PHASE DIAGRAMS, IV. Kaufman, L.; Nesor, H. (Manlabs, Inc., Cambridge, MA). Metall. Trans., A; 6A: No. 11, 2123-2131(Nov 1975).

Explicit descriptions of the Fe–Mo, Fe–W, Fe–Nb, W–Cr and Ti–W binary systems have been developed in line with lattice stability, thermochemical and phase diagram data. These descriptions, along with similar results derived previously, have been employed to calculate isothermal sections in the Cr–Al–Fe, Fe–Mo–Cr, Fe–W–Cr, Ni–Al–Co, Nb–Ti–W, Ti–W–Mo, Cr–W–Mo, Ni–

Mo–W, and Ni–W–Ti systems for comparison with experimental results. The effects of carbon impurities on miscibility gap formation in the Ti–W, Nb–Ti–W, Ti–W–Mo and Cr–W–Mo systems are discussed. (auth)

15288 STUDY OF RETAINED AUSTENITE IN A FINE-GRAINED Fe–12Ni–0.25Ti ALLOY. Hwang, S. K.; Jin, S.; Morris, J. W. Jr. (Univ. of California, Berkeley). Metall. Trans., A; 6A: No. 11, 2015-2021(Nov 1975).

The behavior of retained austenite in a fine-grained Fe–12Ni–0.25Ti cryogenic alloy ssytem was investigated. When the alloy was held at a temperature within the two phase (alpha + gamma) field austenite reversion occurred by a diffusion-controlled process. The redistribution of solute elements appeared to control the stability of the reverted austenite. The microstructural appearance of the retained austenite was examined using transmission electron microscopy. A preferential distribution of the austenite phase along martensite lath boundaries was observed. A precipitate-correlated austenite was also found to occur. The beneficial effect of introducing retained austenite appeared in the improvement in the tensile elongation as well as in the Charpy impact toughness at low temperatures. The retained austenite in this system did not improve K/sub IC/ at -196^{0}C. On the contrary, samples containing retained austenite showed increased susceptibility to unstable crack propagation in low temperature fracture toughness tests. (auth)

15289 MICROSTRUCTURAL STABILITY OF TITANIUM-MODIFIED TYPE 316 AND TYPE 321 STAINLESS STEEL. Grot, A. S. (Pratt and Whitney Aircraft, East Hartford CT); Spruiell, J. E. Metall. Trans., A; 6A: No. 11, 2023-2030(Nov 1975).

Optical metallography, transmission electron microscopy, and x-ray diffraction from bulk extracted residues were used to investigate the microstructural stability in the temperature range 450 to 950^{0}C of a titanium-modified type 316 stainless steel and to compare this steel to a type 321 heat. The effect of cold deformation prior to aging was also investigated. Compared with standard type 316 stainless steel, the nucleation of $M_{23}C_6$ was delayed and its growth retarded in the titanium modified alloy due to early formation of TiC and $Ti_4C_2S_2$ which reduced the carbon content in the matrix. Precipitation of the intermetallic sigma and phi phases was faster in the titanium modified alloy. The type 321 material formed both $M_{23}C_6$ and the intermetallic phases less rapidly than either standard or titanium-modified type 316 steels. The relative tendencies toward intermetallic compound formation in various austenitic stainless steels are discussed in terms of an effective equivalent Cr content remaining in the austenitic matrix after carbide precipitation. Cold work accelerated the precipitation rate of $M_{23}C_6$ and sigma, but it suppressed phi formation due to preferential early sigma formation. Early sigma formation was often associated with recrystallization of the cold worked matrix. Mechanisms accounting for this behavior are discussed. (auth)

15290 FACTORS INFLUENCING THE CREEP STRENGTH OF HOT PRESSED BERYLLIUM. Webster, D.; Crooks, D. D. (Lockheed Palo Alto Research Lab., CA). Metall. Trans., A; 6A: No. 11, 2049-2054(Nov 1975).

The parameters controlling the creep strength of hot pressed beryllium block have been determined. Creep strength was improved by a high initial dislocation density, a coarse grain size, and a low impurity content. The impurities most detrimental to creep strength were found to be aluminum, magnesium, and silicon. A uniform distribution of BeO was found to give creep strength which was inferior to a grain boundary distribution. The creep strength of very high purity, hot isostatically pressed beryllium was found to compare favorably with that of other more commonly used high temperature metals. (auth)

15291 EFFECT OF PROCESSING AND MICROSTRUCTURE ON RENE 95. Shamblen, C. E.; Allen, R. E.; Walker, F. E. (General Electric Co., Cincinnati). Metall. Trans., 6A: No. 11, 2073-2082(Nov 1975).

Rene 95 is a high-strength, wrought nickel-base superalloy used primarily for compressor and turbine disks in advanced aircraft engines. A special thermomechanical processing sequence is described which imparts in Rene 95 a duplex microstructure, consisting of large warm-worked grains surrounded by a fine-grain necklace. Compared with the 100 percent fine-grain material usually produced by conventional processing, the duplex material is shown to have superior high-temperature properties, especially in rupture life/ductility, notched sustained-peak LCF, and residual cyclic life. This study demonstrates the inferior 538 to 649^{0}C mechanical properties associated with the fine-grain material are attributable to oxidation of surface carbides, which allows crack initiation, followed by rapid crack propagation. This environmental effect nucleated failure mechanism was identified in 649^{0}C stress rupture tests and is verified by improved rupture life and ductility of the fine-grain material tested in vacuum or by periodic surface removal during testing in air. In contrast to the fine-grain structure, the duplex structure offers greater resistance to crack propagation by virtue of its large warm worked grains and hence exhibits superior rupture ductility. (auth)

15292 FRACTURE OF DRAWN TUNGSTEN WIRES. Lee, D. (General Electric Co., Schenectady, NY). Metall. Trans., 6A: No. 11, 2083-2088(Nov 1975).

Conditions that govern the process of fracture in fibrous material were examined with fine, heavily deformed tungsten wires. In particular, the nature of interaction between fiber rupture and delamination in the fracture process was determined by deforming wires under different loading conditions. This was accomplished by testing fine wires under simple uniaxial and bend-and-stretch loading conditions so that the effective stress state could be altered in the deforming fibers. Results of mechanical testing and scanning electron microscopy examination indicated that the process of fracture was controlled by fiber rupture but only to the extent that it could be accommodated by the delamination of fiber interface. The degree of the delamination process in turn was dependent on the magnitude of the radial stress in outer fibers. This view point was supported by an experiment with wires that contained surface flaws. (auth)

15293 OBSERVATION OF TRANSIENT STRESS STATES IN EUTECTIC COMPOSITE CREEP. Garmong, G. (Rockwell International Science Center, Thousand Oaks, CA). Metall. Trans.; 6A: No. 11, 2155-2157(Nov 1975).

Results are presented of experiments in which strain-time creep data are used to determine the stress transients present in individual phases of Ni–45.5 wt percent W eutectics. The results confirm a previously developed theory of transient stress states in composite creep. (JRD)

15294 EFFECT OF A VANADIUM ALLOY ON THE MECHANICAL PROPERTIES OF [CHROMIUM–NICKEL–MOLYBDENUM] STEEL 40KhMNL. Primerov, S. P.; Babaskin, Yu. Z.; Gusev, V. I. Liteinoe Proizvod.; No. 12, vp(Dec 1974). (In Russian).

The effect of V, introduced as a V-rich alloy with Al and Ti, on the structure and mechanical properties of Cr–Ni–Mo 40 KhNML steel was studied. These additives were added to the ladle. Modification with V, Al, and Ti increased the ductility and impact strength of the steel by a factor or two, while making very little difference to the strength (UTS 100 to 120 kg/mm^2). The YS/UTS ratio, however, increased from 90 to 92%. The use of V is strongly recommended for improving the physico-mechanical properties of structural steels. (Metals Abstr.)

15295 MEASUREMENT OF THE ZERO POINT OF A METAL IN PURE SOLVENT. Antropov, K. I.; Gerasimenko, Yu. S.; Yatsyuk, L. A. Elektrokhimiya; 10: No. 10, 1609(Oct 1974). (In Russian).

The zero points of Hg and an In amalgam (4.95 mole-%) were measured using the fact that on simultaneous contact of two different metals with a solvent the magnitude of the voltage at the moment of contact is close to the difference in zero point of these metals. The value for the difference in water was −0.190 ± 0.020 V. Taking the value for the zero point of Hg in water of 0.190 ± 0.003 V, the value for the In amalgam was calculated to be −0.380 ± 0.026 V, which lies between the values of −0.354 and −0.397 V found by other methods. (Metals Abstr.)

15296 DETERMINATION OF THE ZERO POINT OF AN INDIUM AMALGAM. Antropov, L. I.; Gerasimenko, Yu. S.; Yatsyuk, L. A. (Elektrokhimiya; 10: No. 10, 1578-1580(Oct 1974). (In Russian).

The zero point of an amalgam containing In 4.94% in Hg was determined by extrapolation of the potential of zero charge (p.z.c.) obtained by a direct impulse method to zero concentration. The circuit is described which enables measurements to be made in dilute HCl solutions (0.000625 to 0.01N). The lower value of the change of p.z.c. with HCl concentration of the In amalgam compared with Hg may be explained by the lower specific adsorption of Cl^- ions in the case of the In amalgam. (Metals Abstr.)

15297 EFFECT OF IMPURITIES IN TANTALUM ON THE ELECTRICAL CONDUCTIVITY OF THE METAL/OXIDE/ELECTROLYTE SYSTEM. Orlov, V. M.; Odynets, L. L.; Ryungenen, T. I. Elektrokhimiya; 10: No. 8, 1238-1241(Aug 1974). (In Russian).

A study was made of the influence of alloying additions (W, C, Mo, C + W, C + Mo) to Ta on the electrical conductivity of the metal/oxide/electrolyte system. Additives giving rise to the formation in Ta of carbides and thus facilitating an increase in

the number of defects in the anodic oxide film had an appreciable influence on the magnitude of the ohmic and electronic components of the total current flowing through the Ta/Ta_2O_5/electrolyte system. (Metals Abstr.)

15298 HEAT TRANSPORT PROPERTIES OF TUNGSTEN, ALUMINA, AND POLYCRYSTALLINE GRAPHITE UP TO 2700°K. Fitzer, E.; Weisenburger, S. pp 42-56 of Advances in Thermal Conductivity. Reisbig, R. L. (ed.). Rolla, MO; Univ. of Missouri (1974).

Direct electrical heating methods to determine thermal conductivity avoid the uncertainty of specific heat data, have an accuracy of +- 3 to 4 percent at 2500°K and are an alternative for diffusivity measurements at high temperature. Their use is limited to electrically conducting materials. For some pure metals or polycrystalline graphite, low-temperature data can be extrapolated to higher temperature. (Metals Abstr.)

15299 THERMODYNAMIC INVESTIGATIONS ON THE BINARY LIQUID ALLOYS OF TELLURIUM WITH GALLIUM, INDIUM, AND THALLIUM. Predel, B.; Piehl, J.; Pool, M. J. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Metallkunde; Max-Planck-Institut fuer Metallforschung, Stuttgart (F. R. Germany). Inst. fuer Werkstoffwissenschaften). Z. Metallkd.; 66: No. 5, 268-274(May 1975). (In German).

14 figs.; 1 tab.; 13 refs.

The thermodynamic properties of liquid tellurium-indium, tellurium-gallium and tellurium-thallium alloys have been investigated using vapor pressure measurements and solution calorimetry. The results obtained showed that the kind of interatomic bonding in the liquid solutions investigated does not differ in its salient features from the nature of the bonding in analogous solid compounds with a strong heteropolar contribution to the binding forces. The shape of the ΔH^L-x-curves in the tellurium-indium and tellurium-thallium systems could be explained with the assumption that the concentration fluctuations in the liquid solutions correspond largely with the atomic arrangements in the solid phases. Analysis of the concentration dependence of the mixing enthalpies using the assumption that the total mixing enthalpy is composed additively of an association part and a statistical atom distribution part gives a maximum mole fraction of the associates of 0.24 (at $x_{Te} = 0.5$) in the system indium-tellurium and of 0.25 (at $x_{Te} = 0.4$) in the system thallium-tellurium. (DE)

15300 STRUCTURE AND SUPERCONDUCTIVITY OF TERNARY AND QUATERNARY A15 PHASES BASED ON Nb_3Al. Khan, H. R.; Raub, C. J. (Forschungsinstitut fuer Edelmetalle und Metallchemie, Schwaebisch Gmuend (F. R. Germany)). Metall; 29: No. 7, 673-676(Jul 1975). (In German).

17 figs.

The influence of silicon, boron, and carbon additions on the superconducting transition, the lattice constants, as well as on the metallographic structure of the A15 phases Nb_3Al and $Nb_3(Al,Ge)$ was investigated. At 900°C, about 2 at.% C or B dissolves in $Nb_3(Ge,Al)$ where the lattice of the A15 phase contracts. The solubility of both elements is dependent on temperature. With the appropriate temperature treatment borides or carbides are precipitated. The interstitial uptake of carbon or boron by the A15 lattice has little effect on the superconducting critical point. The same applies for annealing at 900°C. Cooling rate of the melt and after annealing very strongly influence the microstructure of the alloys. With an uptake of maximum 7 at.% Si, the Nb_3Al lattice expands but the critical point remains unchanged. The precipitations arising from heat treatment can be taken as "flux pinnings" centers. It can thus be expected that the critical current density of this type of carbon boron contained alloys is relatively high. (DE)

15301 THE TEMPERATURE DEPENDENCE OF THE DIFFUSION COEFFICIENT AND OF THE TRAPPING RATE OF POSITRONS IN METALS. Seeger, A. (Max-Planck-Institut fuer Metallforschung, Stuttgart (F. R. Germany). Inst. fuer Physik; Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Theoretische und Angewandte Physik). Appl. Phys.; 7: No. 4, 257-263(Aug 1975).

44 refs.

The paper explores the consequences of metastable self-trapping of positrons for the temperature variation of positron diffusion coefficients and trapping rates. It is shown that the diffusion coefficient is expected to decrease with increasing temperatures from a value determined by the scattering of positron Bloch waves by acoustic phonons to a much lower one governed by a hopping process. The temperature variation of the rate of trapping by small defects such as vacancies is more complicated since only at high temperatures can we expect it to be limited by the positron diffusion coefficient. At low temperatures the observed magnitude of the rate of trapping at monovacancies can only be understood if the trapping rate is controlled by the rate of capture of positrons that have arrived at the trap. (DE)

15302 THE SURFACE ENERGY OF SOLID MATERIALS AS MEASURED BY ULTRASONIC AND CONVENTIONAL TEST METHODS. Pt. 2. Wawra, H. Z. Metallkd.; 66: No. 8, 492-498(Aug 1975). (In German).

11 figs.; 11 tabs.; 41 refs.

The temperature dependence of the free surface energy of solid materials determined by ultrasonic test methods is compared with the results of other measuring methods. Similar results are obtained by all techniques. (DE)

15303 COBALT-COPPER-(IRON)-MISCH METAL PERMANENT-MAGNET ALLOYS. Schaefer, G.; Wigand, H. H. (Deutsche Edelstahlwerke A. G., Krefeld (F. R. Germany). Forschungsinstitut). Metall; 29: No. 2, 113-121(Feb 1975). (In German).

20 figs.; 3 tabs.; 27 refs.

The magnetic properties of $Co_{5-x}Cu_xCeMM$ alloys (CeMM: cerium misch metal) were investigated. The alloys were thus homogenized at temperatures between 1,000 and 1,100°C, quenched in water, and then annealed. Maximum coercive field strengths of 230 kA/m were achieved with stoichiometric composition. Considerably better results (maximum 500 kA/m) were obtained with alloys where the cobalt was partly substituted by iron. Due to the high coercive field strength and the high magnetic saturation polarization in connection with the good perpendicularity of the demagnetization curves, iron containing alloys of the type $Co_{5-x-y}Cu_xFe_yCeMM$ can be used as synthetic bonded magnets and probably also as sinter magnets. The isothermal intersection at 1,000°C was drawn up from the investigated alloy region of the system CoCuCeMM and the solubility region of the homogeneous $Co_{5-x}Cu_xCeMM$ compounds was determined. (DE)

15304 COMPARISON OF POWDER METALLURGICALLY PRODUCED WEAR RESISTANT COBALT ALLOYS WITH CORRESPONDING CASTING MATERIALS. Drapier, J. M.; Diderrich, E.; Coutsouradis, D. (Centre de Recherches Metallurgiques, Liege (Belgium)). Kobalt; No. 3, 59-64(1974). (In German).

From IMD/ASM symposium on advances in the strengthening of superalloys; Chicago, Ill. (1 Oct 1973). 15 figs.; 1 tab.; 3 refs.

Microstructure and mechanical properties of cast and powder metallurgically produced wear-resistant cobalt alloys were compared. The test material had the composition: Co-26% Cr-4.5% W-1% Ni-1.2%C. The powder was processed by heat extrusion or by isostatic cold pressing followed by sintering; the samples thus obtained were selectively drop-forged. The powder metallurgically produced material showed to be different to the corresponding cast material by a fine-grained, dislocation-rich microstructure with uniform carbide distribution. This microstructure is responsible for the considerable increase in hardness and yielding observed up to temperatures of 650°C. The powder metallurgically produced material furthermore has at least the same if not a better temperature change resistance and wear resistance than the cast alloy. (DE)

15305 THE SURFACE ENERGY OF SOLID MATERIALS AS MEASURED BY ULTRASONIC AND CONVENTIONAL TEST METHODS. Pt. 1. Wawra, H. Z. Metallke.; 66: No. 7, 395-401(Jul 1975). (In German).

11 figs.; 4 tabs.; 34 refs.

The temperature dependence of the free surface energy of solid materials determined by ultrasonic test methods is compared with the results of other measuring methods. Similar results are obtained by all techniques. (DE)

15306 RECRYSTALLIZATION OF DOPED TUNGSTEN WIRE. Warlimont, H.; Necker, G.; Schultz, H. (Max-Planck-Institut fuer Metallforschung, Stuttgart (F. R. Germany)). Z. Metallkd.; 66: No. 5, 279-286(May 1975).

8 figs.; 54 refs.

The microstructural changes during recovery and recrystallization of doped lamp wire tungsten have been investigated by scanning and transmission electron microscopy both qualitatively and quantitatively. Bubble formation on subgrain and grain boundaries was found to be a prominent process apart from the break-up of elongated pores into bubbles. A quantitative assessment of the boundary energy providing the main driving stress and bubble pinning exerting the main impeding stress can fully account for the delayed recrystallization process and the resulting creep resistant microstructure. (DE)

15307 LOW TEMPERATURE BASAL CLEAVAGE IN SINGLE CRYSTALS OF BERYLLIUM AND BERYLLIUM ALLOYS WITH COPPER. Wilhelm, M.; Aldinger, F. (Max-Planck-Institut fuer Metallforschung, Stuttgart (F. R. Germany). Inst. fuer Werkstoffwissenschaften). Z. Metallkd.; 66: No. 6, 323-328(Jun 1975).

9 figs.; 1 tab.; 15 refs.

Zone-refined beryllium single crystals were prepared with up to 1 at.% Cu in solid solution. The influence of these copper additions on the propagation energy of cracks parallel to basal planes was investigated by the DCB (double cantilever beam) technique at 77°K. The crack surfaces are relatively smooth, and the energy of crack propagation appears to be independent of the copper content. The structure of the crack surfaces and the increase of the measured fracture energy above the theoretical value of the specific surface energy of the basal planes are discussed. An explanation is given in terms of plastic events taking place along basal and prismatic slip planes at locations where the crack propagation is obstructed. (DE)

15308 EXCITATION OF SURFACE PLASMONS IN METAL PARTICLES BY FAST ELECTRONS AND X-RAYS. Lushnikov, A. A.; Simonov, A. J. (Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR)). Z. Phys., B; 21: No. 4, 357-362(Aug 1975).

9 refs.

The cross sections for excitation of surface plasmons by fast electrons and x-rays are calculated within the random phase approximation for a spherical metal particle. The results are compared with those obtained within the hydrodynamic model of a free electron gas. (DE)

15309 GRAIN-REFINEMENT OF ALUMINIUM ALLOYS. Warr, B. D.; Smith, R. W. (Queen's Univ., Kingston, Ontario (Canada). Dept. of Metallurgical Engineering). Z. Metallkd.; 66: No. 6, 360-361(Jun 1975).

1 fig.; 1 tab.; 6 refs.

A discriminant analysis has been made of those features which cause certain transition metals (Hf, Ta, Ti) to induce considerable grain refinement of aluminium whereas others (Cr, Mo, Nb, W, V, Zr) have little effect. It was concluded that the most important requirement for effective grain refinement was that the addition should produce a large freezing range when alloyed with aluminium. (DE)

15310 MOESSBAUER EFFECT AND ITS APPLICATIONS AT VERY LOW TEMPERATURES. Williams, J. M. (Univ., Sheffield, Eng.). Cryogenics; 15: No. 6, 307-322(Jun 1975).

The basic ideas and difficulties associated with nuclear gamma resonance absorption are discussed culminating with Moessbauer's great discovery of recoiless γ emission and absorption. The extremely high inherent resolution of the Moessbauer γ-rays provides a simple and powerful method of detecting extremely small changes in energy. In this review the applications of Moessbauer spectroscopy to problems in magnetism, superconductivity, Kondo effect, nuclear polarization and relativity are discussed, with particular regard to use of very low temperatures and the information thus obtained. Basic Moessbauer systems and cryostats which enable temperatures down to ~30 mK to be maintained for long periods are described. An interesting application discussed is where the Moessbauer effect may itself be used as an absolute thermometer incorporating its own internal calibration. (auth)

15311 EXPERIMENTAL INVESTIGATIONS OF THE PLASTICITY OF Ta SINGLE CRYSTALS. Lachenmann, R.; Schultz, H. (Max-Planck-Institut fuer Metallforschung, Stuttgart (F. R. Germany). Inst. fuer Physik). Z. Metallkd.; 66: No. 8, 443-452 (Aug 1975). (In German).

17 figs.; 57 refs.

High-purity and nitrogen-doped tantalum single crystals were chosen to investigate the plastic behavior of a bcc metal and its dependence on deformation temperature, crystal orientation, and interstitial solute content. The crystal preparation and purification was carried out by electron-beam zone refining in an ultra-high vacuum system specifically designed for this purpose. Experimental data were obtained on the temperature dependence of the flow stress, the asymmetry of glide, and the working-hardening characteristics. These results support the view that the special structure of the screw dislocation in the bcc lattice is responsible for the thermally activated dislocation movement and the asymmetry properties. (DE)

15312 MAGNETIC SUSCEPTIBILITY OF AMERICIUM AND CURIUM METAL. Kanellakopulo, B. (Gesellschaft fuer Kernforschung mbH, Karlsruhe, Ger.); Blaise, A.; Fournier, J. M.; Mueller, W. Solid State Commun.; 17: No. 6, 713-715(15 Sep 1975).

The magnetic susceptibility of americium metal is almost temperature independent between room and liquid helium temperatures. Curium metal shows Curie-Weiss paramagnetism with antiferromagnetic ordering around 52°K; its effective magnetic moment supports the hypothesis of localized 5f electrons and a metal valence of three. (auth)

15313 COMMENT ON THE STRUCTURAL PHASE TRANSITION IN A15 COMPOUNDS. Szabo, N. (Univ., Geneva). J. Phys., C (London); 8: No. 19, L397-L399(7 Oct 1975).

The martensitic transformation in A15 compounds in the presence of internal strains and of external mechanical stress is examined on the basis of the Landau theory of phase transitions. The free energy of the model coincides with the free energies of the three-state Potts model and provides an explanation for the different martensitic transition temperatures for Nb_3Sn and V_3Si crystals. It is argued that in these compounds the linear chains of Nb and V atoms may be broken in the tetragonal phase. The critical behavior is discussed. (auth)

15314 NUCLEAR SPIN-LATTICE RELAXATION IN SMALL SUPERCONDUCTORS IN MAGNETIC FIELD. Takahashi, T.; Kobayashi, S.; Sasaki, W. (Tokyo Univ.). Solid State Commun.; 17: No. 6, 681-684(15 Sep 1975).

The magnetic field dependence of nuclear spin-lattice relaxation time in zero-dimensional superconductors of Al is measured. The Zeeman effect of conduction electron is observed. The order parameter fluctuation and the discreteness of one-electron levels are discussed. (auth)

15315 AERODYNAMIC DIAMETER OF BRANCHED CHAIN-LIKE AGGREGATES. Kops, J.; Dibbets, G.; Hermans, K.; Van de Vate, J. F. (Stichting Reactor Centrum Nederland, Gravenhage). J. Aerosol Sci.; 6: No. 5, 329-333(Sep 1975).

The aerodynamic behavior of branched chain-like aggregates of iron oxide as well as gold particles is studied using a centrifugal aerosol spectrometer according to Stöber and Flachsbart. The aerosols, which were radioactively labeled, were produced by an exploding wire. The size distribution of the primary particles of the aggregates is determined by means of electron microscopy with negatively stained catalase crystals as an internal length standard. A relation between the aerodynamic diameter (d_a) and the number of primary particles (n) of the aggregates is obtained. This relation can be divided in a region for which d_a is proportional to $n^{\frac{1}{2}}$ and a region for which d_a is proportional to $n^{\frac{1}{3}}$. There is a significant accordance between these results and the results obtained by Stöber for aggregates of monodisperse polystyrene spheres. (auth)

15316 DISLOCATION RESONANCE IN SUPERCONDUCTING TIN. Das, H. L.; Chaudhuri, K. D. (Univ., Delhi). Cryogenics; 15: No. 9, 517-520(Sep 1975).

Ultrasonic attenuation in the superconducting state of strained samples of single crystals of tin shows a strong dependence on the dislocation density. The dislocation density is estimated with the help of a suitable etch pit method. The etch pits are square in shape and exhibit symmetric dislocation lines normal to the (100) planes. The number of etch pits reveals a direct dependence on the physical state of the specimen. The dislocation density estimated by this etch pit method can be related to the extra attenuation $\Delta\alpha_s$ and shows a resonant behavior, and the resonance frequency is dependent on the dislocation density. It is also observed that the functional relationship between the resonance frequency and the dislocation density is different in different regions of the dislocation density. (auth)

15317 CRYSTAL STRUCTURE AND LATTICE CONSTANTS OF TRANSITION METAL-DIBERYLLIDES AND -DIBORIDES IN TERNARY SOLID SOLUTIONS. Stuemke, M.; Petzow, G. (Max-Planck-Institut fuer Metallforschung, Stuttgart (F. R. Germany). Inst. fuer Werkstoffwissenschaften). Z. Metallkd.; 66: No. 5, 292-297(May 1975). (In German).

13 figs.; 4 tabs.; 10 refs.

By reactive hot pressing binary intermetallic TX_2-compounds (T = Cr, Mo, Nb, Ta, Ti, Zr; X = Be, B) and alloys thereof were produced. In the alloy series TBe_2-TB_2 and TBe_2-$T'Be_2$ the regions of solid solubility could be determined through metallographic and x-ray investigations. The laws governing the structural relationships could be verified by lattice parameter measurements. Whether the Laves phase type beryllides have C15- or C14-structure depends on the atomic volume of the T-component. If it is smaller than 17×10^{-3}nm^3 the diberyllide crystallizes in the C14-lattice accompanied by a volume decrease. If the atomic volume is larger, then the C15-lattice is favored accompanied by volume expansion. For the diborides with $C3^1/_2$-structure the

number of electrons in the d-band governs structural stability. In beryllium containing diboride solid solutions the phase boundary is determined by the conditions that there are only 9.2 electrons in the d-band of the T-component. (DE)

15318 RESISTIVE BEHAVIOR IN THE SINGLET-GROUND-STATE SYSTEM $La_{1-x}Pr_xSn_3$. Abou Aly, A.I.; Bakanowski, S.; Berk, N.F.; Crow, J.E.; Mihalisin, T. (Department of Physics, Temple University, Philadelphia, Pennsylvania 19122). Phys. Rev. Lett. 35: No. 20, 1387-1390 (17 Nov 1975).

It is shown that the resistive behavior of $PrSn_3$, namely a local maximum followed by a rather abrupt drop at low temperatures, is not solely due to the presence of magnetic ordering. This result is established by the resistive behavior of the $La_{1-x}Pr_xSn_3$ where the salient resistive features persist even to values of x for which T_N has been depressed to zero. An explanation in terms of inelastic scattering from crystalline-electric-field-split ion levels is presented. (auth)

15319 FIRST OBSERVATION OF A KONDO EFFECT FROM PRASEODYMIUM EXCITED CRYSTAL-FIELD LEVELS IN $La_{1-x}Pr_xSn_3$ COMPOUNDS. Lethuillier, P. (Laboratoire de Magnétisme, Centre National de la Recherche Scientifique, 38042 Grenoble-Cedex, France); Haen, P. Phys. Rev. Lett. 35: No. 20, 1391-1393 (17 Nov 1975).

The electrical resistivity of $La_{1-x}Pr_xSn_3$ compounds (x=0.0, 0.1, 0.2, 0.4, and 1.0) has been measured between 1 and 300 K. A resistivity minimum is observed, which arises from a Kondo effect due to excited crystal-field levels of the praseodymium ion, the ground state being nonmagnetic. The plot of $\rho(La_{1-x}Pr_xSn_3) - \rho(LaSn_3)$ versus $\ln T$ is approximately linear above 25 K. (auth)

15320 "CRYSTAL FIELD" IN LIQUID RARE-EARTH METALS. Millhouse, A.H.; Furrer, A. (Institut für Reaktortechnik, Eidgenössische Technische Hochschule, CH-8049 Zurich, Switzerland). Phys. Rev. Lett. 35: No. 18, 1231-1233 (3 Nov 1975).

Neutron-inelastic-scattering measurements have been performed on liquid La, Ce, and Pr. The results demonstrate that a well-defined "crystal field" exists in liquid rare-earth metals and that the scattering can be understood if it is assumed that the crystal-field potential is uniaxial. (auth)

15321 SUSCEPTIBILITY OF INTERCONFIGURATION-FLUCTUATION COMPOUNDS. Sales, B.C.; Wohlleben, D.K. (Institute for Pure and Applied Physical Sciences, University of California, San Diego, La Jolla, California 92037). Phys. Rev. Lett. 35: No. 18, 1240-1244 (3 Nov 1975).

We present a simple model for the magnetic susceptibility of rare-earth compounds which exhibit interconfiguration fluctuations (ICF). It is shown that the temperature dependence of the magnetic susceptibility of several ICF Yb compounds can be fitted quantitatively, assuming an energy separation E_{ex} between the two configurations and an intrinsic lifetime τ due to the 4*f*-shell-conduction-electron interaction. With the parameters E_{ex} and τ obtained from such fits it is possible to predict the temperature dependence of the valence. (auth)

Radiation Effects

Refer also to abstracts 15262, 15580, 16291, 16294, and 16366.

15322 (AERE-TP-610) VOID SWELLING IN THIN FOILS. Savino, E.J. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Jul 1975. 23p. Dep. NTIS (US Sales Only) $3.50.

The distribution of irradiation-produced defects in thin foils of steel and aluminium is calculated using Brailsford and Bullough's rate theory of swelling plus appropriate boundary conditions. The dependence of the void denuded zone on temperature, dose, radiation damage rate and sink strength is studied. (auth)

15323 (AI-ERDA--13164) SWELLING AND MECHANICAL PROPERTY CHANGES IN NEUTRON-IRRADIATED COLD-ROLLED TYPE 316 STAINLESS STEEL. Garr, K. R.; Pard, A. G. (Rockwell International Corp., Canoga Park, Calif. (USA). Space Div.). 1975. Contract AT(04-3)-824. 22p. Dep. NTIS $4.00.

Samples of cold-rolled Type 316 stainless steel were irradiated in EBR-II to a fluence of about 8×10^{25} n/m^2 (E greater than 0.1 MeV) at 500 and 600°C. Three sample configurations were used--small sheet tensile samples, small right-circular cylinders for immersion density, and thin foils for transmission-electron microscopy (TEM). TEM revealed voids in the foils irradiated at both temperatures. Immersion density results, however, indicated swelling only in the sample irradiated at 600°C. Considerable recovery and precipitation were observed in foils irradiated at both temperatures. Results of tensile tests on irradiated samples showed a decrease in yield strength and an increase in ductility compared to unirradiated controls. (auth)

15324 (BLG-504) ASSESSMENT OF NEUTRON-INDUCED EMBRITTLEMENT OF AISI 316 AND OTHER AUSTENITIC ALLOYS. Cheema, S. U. (Centre d'Etude de l'Energie Nucleaire, Brussels (Belgium)). Mar 1975. 23p. Dep. NTIS (US Sales Only) $3.50.

A literature survey is the basis of an evaluation to be made of the influence of fast neutron fluence, temperature and strain rate on the ductility loss of austenitic stainless steel (AISI 316 solution annealed and 20% cold worked 316 stainless steel). The experimental data given lie in the range of fluence 0.1×10^{22} to 7×10^{22} n.cm^{-2} and irradiation temperatures of 400 to 750°C. The effects of irradiation are described in terms of irradiation produced microstructural and deformation characteristic changes. For the fluence region where experimental results are not yet available a mechanism of ductility loss due to J. J. Holmes et al. is described, which helps to extrapolate the results to higher fluence. (auth)

15325 (BLG-505) ASSESSMENT OF THE NEUTRON-INDUCED SWELLING OF AISI 316 STAINLESS STEEL AND OTHER POTENTIAL FAST REACTOR CORE MATERIALS. Vandermeulen, W.; Van Asbroeck, P. (Centre d'Etude de l'Energie Nucleaire, Brussels (Belgium)). Mar 1975. 21p. Dep. NTIS (US Sales Only) $3.50.

A survey is given of the swelling behavior of AISI 316 steel due to neutron irradiation. It is shown that the cold-worked material swells less than the solution-treated material. Irradiation of this steel as cladding leads to much higher swelling than material irradiations, especially at temperatures above 500°C. The possible explanations for this phenomenon, i.e., composition, precipitation and state of stress, are discussed. Other materials with promising swelling properties are very briefly reviewed. (20 references, 8 fig) (auth)

15326 (CONF-750989--3) HVEM QUANTITATIVE STEREOSCOPY THROUGH THE FULL DAMAGE RANGE OF AN ION-BOMBARDED Fe--Ni--Cr ALLOY. Diamond, S.; Baron, I. M.; Bleiberg, M. L.; Bajaj, R.; Chickering, R. W. (Atomics International Div., Canoga Park, Calif. (USA)). 1975. 24p. Dep. NTIS $3.50.

From international conference on radiation effects and tritium technology for fusion reactors; Gatlinburg, Tennessee, USA (30 Sep 1975).

The swelling of a Ni-ion irradiated Fe-25 percent Ni-15 percent Cr alloy has been investigated employing high voltage (1 MeV) electron microscopy. Helium pre-injected samples were irradiated to a maximum dose of 92 dpa with 3.5 MeV $^{59}Ni^+$ ions at 600, 650, 700 and 750°C. By means of quantitative stereoscopy throughout the full range of ion damage, the void morphology, swelling, and dislocation morphology as functions of the distance from the ion-entry surface of the foil were obtained. The dose also varied as a function of depth and, with this technique, swelling as a function of dose was determined from a single sample at each temperature. Swelling, void concentration, and void size varied with irradiation temperature with the maximum swelling of 7.4 percent occurring at 700°C. Several distinct dislocation configurations could be distinguished progressing inward from the ion-entry surface. The observations suggest that nucleation and growth of voids are related to dislocation densities and possibly to dislocation structure. The swelling-dose relationships were analyzed using a linear expression for each apparent swelling regime and the results interpreted in terms of the Brailsford and Bullough statistical rate theory. Two distinct steady-state swelling regimes exist at each irradiation temperature and the difference in the rates is attributed to the different kinetic development of the dislocation structure and densities in the two stages. (auth)

15327 (CSNSM-TS-75-2) STUDY OF IMPURITY-DEFECT INTERACTION BY PERTURBED ANGULAR CORRELATIONS: ^{111}Cd IN SILVER. Sage, F. (Centre National de la Recherche Scientifique, 91- Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse; Paris-11 Univ., 91- Orsay (France)). 1975. 140p. (In French). INIS.

The quadrupole interaction of ^{111}Cd nuclei following the decay of ^{111}In implanted by the $^{109}Ag(\alpha,2n)^{111}In$ reaction into a cubic Ag lattice was measured using the time-differential perturbed-angular correlation technique. A nonvanishing quadrupole interaction corresponding to a distribution of electric field gradients was observed, due to the interaction between the ^{111}Cd impurity and the defects created during the recoil of ^{111}In nuclei. For low temperature (77°K) irradiations, it has been shown that the angular correlation pattern depends on the intensity of α beam current, due to the interaction between defect cascades at high α beam intensity; and it also depends on the annealing of the irradiated sample at different temperatures; the change in the defect con-

figuration around the impurities is then due to the mobility of the various defects. (FR)

15328 (ERDA-tr-86, pp 74-80) EUROPEAN CONFERENCE ON THE RADIATION BEHAVIOR OF MATERIALS FOR FUEL ROD JACKETS AND NUCLEAR COMPONENTS. Closs, K. D. Jan 1975. Translated from German report.

In reports of the Nuclear Research Center, Karlsruhe. 7th annual publication.

Experimental results and theoretical concepts given at the conference are presented concerning pore formation under irradiation, effects of irradiation on structural stability, and radiation effects on mechanical properties of materials. (JRD)

15329 (HEDL-SA-765) RELATIONSHIP BETWEEN EQUIVALENT CHROMIUM CONTENT AND IRRADIATION-INDUCED SWELLING IN 316 STAINLESS STEEL. Bates, J. F.; Guthrie, G. L. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Dec 1974. Contract AT(45-1)-2170. 16p. (CONF-750607-39). Dep. NTIS $3.50.

From American Nuclear Society meeting; New Orleans; Louisiana, USA (8 Jun 1975).

A correlation is noted between equivalent chromium content and resistance to irradiation induced swelling in various 316 stainless steel specimens which have slightly different chemical compositions. Several examples are cited where an increased concentration of an alpha-stabilizing minor constituent results in decreased swelling. It is shown that the relative swelling resistance of alloys having the same carbon and equivalent nickel contents is higher for those alloys with the higher equivalent chromium content. (auth)

15330 (INIS-mf-1711) COMPUTER SIMULATION OF RADIATION DAMAGE IN AN ORDERED ALLOY. Schade, G. W.; Edwards, D. R.; Leighly, H. P. (Missouri Univ., Rolla (USA)). 1973. vp. INIS.

From 1973 summer computer simulation conference; Montreal, Quebec, Canada (17 Jul 1973).

A computer program was used to simulate the effects of irradiation on the order-disorder alloy Fe_3Al. The primary purposes of this study were three-fold: first, to test and demonstrate the degree of correspondence to reality that can be realized from this model; secondly, to incorporate advances in computer machinery and software into the model; and lastly, to use the model to determine the response of Fe_3Al to irradiation. The crystal properties examined were: the variance of damage energy threshold with crystal direction; the predominant mechanism(s) responsible for damage; and the means and rates of energy dissipation from the damage zones. A series of approximately 60 runs for 13 crystal directions and static tests. The damage energy thresholds varied from a low of 18.5 eV for the [100] direction to 82 eV in the [123] direction. In all cases the damaged condition consisted of vacancy-interstitial pairs. The number of pairs produced as well as the separation of the vacancies and interstitials depended on both energy and crystal direction. The paths of energy dissipation from the interaction zones were primarily [111] and [100] atom chains, with the relative importance of each type of chain depending again upon the initial energy and crystal direction. (auth)

15331 (KFK-EXT-6/75-4) MECHANICAL PROPERTIES OF CLADDING TUBES MADE FROM SS 1.4988 AFTER IRRADIATION IN TREFOIL EXPERIMENT. Schaefer, L. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung). Sep 1975. 18p. (In German). Dep. NTIS (US Sales Only) $3.50.

Three pins from the Trefoil irradiation experiment DFR-304 were cladded with the austenitic stainless steel 1.4988 (16 Cr, 13 Ni, Nb). No pin failed during the irradiation. Tensile and stress-rupture tests were performed with defueled tubes. Results from the stress-rupture tests at 600°C showed that the most severe damage occurred at the hottest region of the fuel pins. The stress-rupture strength is reduced there to 65% of the strength found for unirradiated material. Moreover, minimum creep-rupture strains of about 1% were measured for specimens from the high temperature region. On the other hand, an increase in the rupture strength by a factor of about 1.2 as well as an increase in yield strength up to 90 kp/mm² were observed for specimens irradiated in the low-temperature region. For those specimens the rupture strains were found to be dependent on the deformation rate and amounted to minimum values of 0.1%. (auth)

15332 YIELD STRENGTH OF FINE-GRAINED VANADIUM PRODUCED BY HIGH-RATE PHYSICAL VAPOR DEPOSITION. Sherman, M. A. (Los Alamos Scientific Lab., N. Mex. (USA)); Bunshah, R. F. (California Univ., Los Angeles (USA). Dept. of Materials). J. Nucl. Mater.; 57: No. 2, 151-154(Aug 1975).

High-rate physical vapor-deposition (HRPVD) techniques were used to produce vanadium bulk deposits with a 0.7 mu m grain size and average yield strength of 36.1 kg/mm². The strength is well above previous values. Vanadium of this grain size is expected to resist void formation and growth under fast-neutron irradiation compared to the recrystallized material. (NL)

15333 ALLOYS OF NICKEL–IRON AND NICKEL–SILICON DO NOT SWELL UNDER FAST NEUTRON IRRADIATION. Silvestre, G.; Silvent, A.; Regnard, C.; Sainfort, G. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Metallurgie). J. Nucl. Mater.; 57: No. 2, 125-135(Aug 1975). (In French)

Effects of fast-neutron irradiation on the swelling of nickel and nickel alloys were studied. Ni-Fe (0-60 at.% Fe) and Ni-Si (0-8 at.% Si) were studied, and the fluences were in the range 10^{20} to 4.3×10^{22} n/cm². In dilute alloys, the added elements are dissolved and reduce swelling, silicon being particularly effective. In more concentrated alloys, irradiated of Ni-Fe and Ni-Si alloys brings about the formation of plate-shaped precipitates of Ni_3X and these alloys do not swell. (NL)

15334 DOSE-RATE DEPENDENCE OF SWELLING AND DAMAGE IN ION-IRRADIATED NICKEL. Menzinger, F. (L'Aquila Univ. (Italy). Istituto di Fisica); Sacchetti, F. (Comitato Nazionale per l'Energia Nucleare, Casaccia (Italy). Lab. Fisica Nucleare Applicata). J. Nucl. Mater.; 57: No. 2, 193-197(Aug 1975).

The results of an irradiation experiment using 46-MeV Ni^{6+} ions from the Variable-Energy Cyclotron facility in Harwell are presented. The dose rate was varied, at a constant total dose, by a factor of 20 and the damage produced examined in the peak region of damage and at smaller depths. The temperature range 450-700°C was investigated. It was found that the temperature dependence of swelling varies with both the dose rate and the dose. (NL)

15335 EFFECT OF INSTANTANEOUS FLUX ON THE FORMATION OF VOIDS IN NICKEL IRRADIATED BY 500 keV Ni^+ IONS. Regnier, P.; Glowinski, L. D. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Section de Recherches de Metallurgie Physique). J. Nucl. Mater.; 57: No. 2, 243-245(Aug 1975). (In French)

Specimens of Ni were irradiated with 2.4 dpa and 24 dpa doses of 500 keV Ni^+ ions, in both cases for an irradiation period 3 h. 20 m. The results were similar to those obtained for Cu, in an earlier series of experiments. (NL)

15336 TEMPERATURE-DEPENDENCE ON THE SPUTTERING YIELD OF SILICON AND GERMANIUM TARGETS. Nizam, J.; Benazeth-Colombie, N. (Toulouse-3 Univ., 31 (France). Lab. de Physique des Solides). Rev. Phys. Appl.; 10: No. 4, 183-186(Jul 1975). (In French)

Si and Ge single crystal targets were bombarded with high doses of 40 keV Ar^+ ions (>10^{17} ions/cm²). The variation of the sputtering yield S as function of the target temperature (50 to 500°C) has been studied. The measurements of S lead to a determination of the annealing temperature (about 350°C for Ge and >400°C for Si). The sputtering yields of perfect single-crystal Ge targets were measured. (FR)

Other Materials

Refer also to abstracts 14278, 15171, 15194, 15226, 15255, 15256, 15260, 15274, 15293, 15298, 15299, 15302, 15305, 15336, and 16263.

15337 (AD/A-006085) POSTRADIATION CHANGES IN CONDUCTIVITY IN IRRADIATED AMMONIUM PERCHLORATE. Zakharov, Yu. A.; Shechkov, G. T. Translated from Izv. Tomsk. Politekh. Inst.; 176: 94-103(1970). 15p. (FSTC-HT-23-1099-73). NTIS $3.25.

The electrical conductivity of NH_4ClO_4 changed considerably after irradiation by γ rays, 4.5-MeV protons or x rays. The minimum dose causing a postradiation change in the conductivity, as well as the conductivity vs. dose was determined. Charge carriers in NH_4ClO_4 are negative. The postradiation conductivty was measured at a continuous heating rate of approximately 2°/min at 20-170. Dielectric losses and thermal emf also were studied. Experimental results are discussed, together with previous data on radiolytic degradation of NH_4ClO_4. (GRA)

15338 (CONF-730857–) PULSED NUCLEAR MAGNETIC RESONANCE AND SPIN DYNAMICS IN SOLIDS. Proceedings of the First Specialized Colloque Ampere Held at Krakow, Poland, 28 August–1 September 1973. Hennel, J. W. (ed.). (Institute of Nuclear Physics, Krakow (Poland)). 1973. 271p. Institute of Nuclear Physics, Krakow, Poland.

Papers presented at the conference are presented. The conference was devoted to the most rapidly developing areas of NMR in studies of solids including pulse methods, high resolution, and spin dynamics. (JRD)

15339 (ERDA-tr-86, pp 40-48) THERMOMECHANICAL LOW TEMPERATURE INVESTIGATIONS ON FILLED AND UNFILLED EPOXIDES. Hartwig, G. (Institute for Experimental Nuclear Physics, Karlsruhe, Ger.). Jan 1975. Translated from German report.

In reports of the Nuclear Research Center, Karlsruhe. 7th annual publication.

An overview of measuring methods and test results on filled and unfilled epoxides is presented. Discussions are included on thermal contraction, heat conductivity, specific heat, and mechanical stability. (JRD)

15340 (IFA-NR-57-1975) SELF-SUPPORTED EPITAXIAL SILICON FILMS. Lazarovici, D.; Popescu, A. (Institutul de Fizica Atomica, Bucharest (Romania)). 1975. 12p. Dep. NTIS (US Sales Only) $3.50.

Methods of removing the p or p^+ support of an n-type epitaxial silicon layer are described, using electrochemical etching. So far only n^+-n junctions have been processed. The condition of anodic dissolution for some values of the support and layer resistivity are given. By this method, very thin single-crystal self-supported targets of convenient areas can be obtained for channeling-blocking experiments. (auth)

15341 (IFTJ-71/PS) HYSTERESIS OF PHASE TRANSITIONS AND MODULATED STRUCTURES IN K_2MoO_4 AND K_2WO_4. Warczewski, J. (Institute of Physics and Nuclear Techniques, Krakow (Poland)). 1975. 26p. Dep. NTIS (US Sales Only) $4.00.

The effect of hysteresis of phase transitions in K_2MoO_4 and K_2WO_4 is observed. The lattice constants, their ratios and elementary cell volumes as well as the values of the modulation vectors p as functions of temperature are presented. It is proved that K_2MoO_4 is a real modulated structure and K_2WO_4 is a real superstructure. (auth)

15342 (INIS-mf-1769, pp 205-217) INHOMOGENEITY AND ANISOTROPY IN PLASTIC DEFORMATION OF SINTERED MATERIALS. Saxl, I.; Cech, B. Sep 1974.

From 4th international conference on powder metallurgy; Strbske Pleso, Czechoslovakia (1 Oct 1974).

In powder metallurgy 74. I. Conference proceedings.

The sources of dispersion hardening in extruded sintered materials are discussed with particular attention to the thermal stability of the hardening. The texture hardening in magnesium-based sintered extruded composites is described as are the effects of secondary recrystallization. The plastic properties of the Mg-MgO-Be composite are briefly considered as an example. (auth)

15343 IMPROVED MANUFACTURING METHODS SEEN AS KEY TO LOWER COST BORON ALUMINUM COMPOSITES. Dittmer, W. D. Mater. Eng.; 79: No. 4, 46-47(Apr 1974).

The price of B filaments (5.6 mils), B/acrylic Al preforms, and diffusion bonded Al decreases with increase in filament production. At a production of 1,000,000 lb/year, the price is predicted to be $16.50, 25.00, and 30.00/lb, respectively. With the development of forming, drilling, welding, and riveting for B/Al component fabrication, the cost will be competitive with conventional Al fabrication costs. Filament production rates to 1977 depend upon the F-15 aircraft production rate. Beyond 1977, it will depend upon the B-10, heavy lift helicopter, and space shuttle demands. (Metals Abstr.)

15344 RESIDUAL STRAIN OF POLYCRYSTALLINE GRAPHITE. II. Relationship Between the Strain and the Energy Dissipated During Compression Tests. Eto, M. (Japan Atomic Energy Research Institute, Tokai-mura, Ibaraki-ken 319-11, Japan). J. Nucl. Mater.; 57: No. 2, 205-211(Aug 1975).

Studies on the relationships between the residual strain and the energy dissipated during the compressive loading and unloading cycles are carried out for nuclear and other commercial graphites. Whether there are correlations between the fracture energy and mechanical properties such as the compressive strength of these materials was also studied. The results show that for needle coke and fine-grained isotropic graphites the residual strain $\epsilon_0 = K_1E^{\frac{1}{2}}$, while for Gilsocarbon graphites $\epsilon_0 = K_2E^{\frac{1}{2}}$. Here, E is the dissipated energy and K_1 and K_2 are constants dependent on the kind of graphite and the specimen orientation. These relationships can be derived on some assumptions concerning the mechanisms for deformation of needle coke or Gilsocarbon graphite. It is also found that both the compressive strength and the fracture strain, are proportional to the square root of the fracture energy for various polygraphites. (NL)

15345 RESIDUAL STRAIN OF POLYCRYSTALLINE GRAPHITE. I. Its Stress Dependence and the Irradiation Effect. Eto, M.; Oku, T. (Japan Atomic Energy Research Institute, Tokai-mura, Ibaraki-ken 319-11, Japan). J. Nucl. Mater.; 57: No. 2, 198-204(Aug 1975).

The stress dependence of the residual strain of various polygraphites is investigated to make clear whether Jenkins' expressions for the residual strain are in agreement with the experimental data. Studies are also made on the effect of neutron irradiation at high temperatures on the stress dependence of the strain. The relationship between residual strain and applied stress can be approximately expressed as $\epsilon_0 = C(\sigma/\sigma_f^2)^n$ over a wide range of applied stress. Here, ϵ_0, σ, and σ_f denote residual strain, applied stress, and fracture stress, respectively. C and n are constants, which depend on both the kind of graphite and the specimen orientation. The values of n for various graphites are not necessarily equal to or larger than two. These facts are inconsistent with the equations of Jenkins. The values of n and C are decreased by neutron irradiation at temperature from 820 to 920°C to a fluence of $3\text{-}9 \times 10^{20}$n/cm^2 (E > 0.18 MeV). This is explained by the change in the population of cracks in the specimen caused by neutron irradiation. (NL)

15346 SPECTROPHOTOMETRIC DETERMINATION OF THE DEUTERIUM CONTENT IN CRYSTALS OF DEUTERATED POTASSIUM DIHYDROGEN PHOSPHATE AND SOLUTIONS USED FOR GROWING THEM. Dmitrenko, L. A.; Korolikhin, V. V. (Gorky Radiophysics Research Inst., USSR). Sov. Phys.-Crystallogr. (Engl. Transl.); 20: No. 2, 282-283(1975).

Translated from Kristallografiya; 20: No. 2, 458-459(1975).

The deuteration was measured of solutions and potassium dihydrogen phosphate (DKDP) crystals grown by the concentrated convection method. For comparison mass spectrometric determinations of the degree of deuteration of DKDP crystals were also made. The degree of deuteration determined spectrophotometrically was 64.5 and 82.5% D, while by mass spectrometry it was 65 and 83 at.% D respectively. (auth)

15347 PREPARATION OF A SINGLE-DOMAIN STATE IN γ-IRRADIATED CRYSTALS OF TRIGLYCINE SULFATE. Belugina, N. V.; Meleshina, V. A.; Yurin, V. A.; Ankudinov, M. A.; Zheludev, I. S. (Inst. of Crystallography, Moscow). Sov. Phys.-Crystallogr. (Engl. Transl.); 20: No. 2, 269-270(1975).

Translated from Kristallografiya; 20: No. 2, 438-440(1975).

Procedures for preparation of single-domain triglycine sulfate crystals and results of irradiation of these crystals are described. It was found that preparation and irradiation conditions can be controlled such that stable-domain crystals are produced. (JRD)

15348 A TELEPHONE CABLE WITH A PROTECTIVE FILLING AND IRRADIATED-POLYETHYLENE INSULATING COATINGS. (to General Cable Corp.). French Patent 2,227,605/A/. 25 Apr 1973. 11p. (In French)

This communication cable comprises a filling and a polyethylene insulating coating on each of the irradiated conductors for preventing the polyethylene from being damaged through contacting the filling material, which is a grease. As a rule, the filling material comprises a petrolatum as its major component. The insulating coatings are irradiated only after they are laid on the conductors but before the latter are gathered together for forming the cable core and put in contact with the petrolatum or the vaseline contained in the filling material. (FR)

15349 BORON CHEMISTRY. II. Second International Meeting on Boron Chemistry Held at Leeds, England, 25-29 March 1974. Wallbridge, M. G. H. (ed.). London; The Butterworth Group (1974). 141p. (CONF-740380-). £4.10.

From 2nd international meeting on boron chemistry; Leeds, UK (25 Mar 1974).

The eight lectures are on: chemistry of boron hydrides; intermediate dicarbo-nido-boranes; metalloboron cage compounds derived from the small carboranes; metallocarboranes and metalloboranes; homolytic reactions of organoboranes; reactions of allylboranes with unsaturated compounds; structural principles in refractory borides; and industrial applications of B compounds. Separate abstracts were prepared for the first paper and for the paper on refractory borides. (DLC)

For abstracts of individual papers see: 15194 and 15350.

15350 RECENT ADVANCES IN THE CHEMISTRY OF BORON HYDRIDES. Schaeffer, R.; Moody, D. C.; Dolan, P. J. (Indiana Univ., Bloomington). pp 423-430 of Boron Chemistry. Vol. II. Wallbridge, M. G. H. (ed.). London; The Butterworth Group (1975).

From 2nd international meeting on boron chemistry; Leeds, UK (25 Mar 1974). See CONF-740380-.

The Lewis base behaviour of B_6H_{10} is reported with a number of Lewis acids including BCl_3, BBr_3, BI_3, AlR_3 (R = Me, Et, i-Bu), B_3H_7, B_4H_8, B_8H_{12} and i-B_9H_{13}. A new preparation of B_6H_9Br is reported as well as the new compounds B_6H_9I, B_6H_8BrI, $B_6H_8I_2$, and related species with CH_3 as well as halogen. Structures are redetermined for a number of boron hydrides. The asymmetric location of the unique bridging proton in B_5H_{11} is established. Structures of SiH_3 and CH_3 pentaboranes were determined by electron diffraction for both the 1 and 2 substituted isomers. Significant bond shortening occurs for SiH_3 in the 1 position. (auth)

15351 METHOD AND EQUIPMENT FOR THE COATING OF FUEL PARTICLES FOR NUCLEAR REACTORS. Wallroth, C. F.; Nickel, H.; Gyarmati, E. (to Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany)). German(FRG) Patent 2,062,794/B/. 23 Jan 1975. 4p. (In German)

The polyhedral structure of the coating of spherical fuel particles for e.g. gas cooled high temperature reactors is reduced. The particles are coated by the pyrolytic decomposition of hydrocarbon gases and/or chloromethylsilanes at temperatures between 1,000 and 2,400°C in a fluidized bed furnace. The formation of slip layers, in which the coating is irregular, on the periphery of the fluidized bed is inhibited by the production of swirling movement of the fuel particles. In addition to this a slanting downward movement is forced upon the carrier gas introduced from the side in the fluidized bed tangential through the oven wall. Furthermore, the carrier gas from below can be spirally added to prevent middle slip layers. (DE)

15352 THE USE OF HARD METALS IN THE PROTECTION AGAINST MINERAL ABRASION. Feld, H. (Ledermann und Co., Horb (F. R. Germany). Abt. LEUCODUR-Entwicklung und Qualitaetskontrolle). Z. Wirtsch. Fertigung; 69: No. 8, 389-390(Aug 1974). (In German).

8 figs.

The wearing properties of WC-Co hard metals are reported. The ratio of Co to WC determines the wear resistance and ducility. The more Co contained in the hard metal, the greater the ducility and the lower the wear resistance. This relationship is shown in a diagram. The abrasion of WC-Co depending on mineral hardness is shown in another diagram. The hard metal surface is shown in two pictures. A few examples in technology illustrate the advantage of applying hard metals in abrasion protection. (DE)

15353 STUDY FOR THE COLLECTION OF DATA ON SPECIAL PROPERTIES OF CONCRETES IN REACTOR PRESSURE VESSEL ENGINEERING. Eibl, J.; Waubke, N. V.; Klingsch, W.; Schneider, U.; Rieche, G. (Technische Univ. Braunschweig (F. R. Germany)). pp 5-51 of Prestressed-Concrete Reactor Pressure Vessel. Berlin, F. R. Germany; Ernst (1974). (In German).

With figs., tabs., and refs.

The aims of this study are: 1) to establish parameters, including the spread required at the present state of knowledge. Variations in the materials properties shall thus be simulated in a theoretical reactor model in order to assess the effects of large spreads; 2) to give limiting values for a preliminary investigation of reactor pressure vessels in cases where no experimental results are available; 3) to provide a basis for the discussion of further important research projects. For this purpose, the following materials properties were dealt with: concrete humidity and shrinkage, creep behavior, elasticity, thermal expansion, thermal conductivity, radiation effects on concrete and steel. All of the above properties were studied with regard to the specific conditions in reactor pressure vessels, i.e. assuming a thick concrete wall with a steel liner on one side and a difference of about 60°C between the inside and outside temperatures. (DE)

15354 FILTRATION BY SIEVES WITH MEMBRANE FILTERS. Fuchs, M. E. A.; Fischer, W. H. (Ernst-Rodenwaldt-Institut, Koblenz (F. R. Germany)). CZ-Chem.-Tech.; 2: No. 11, 439-440(Nov 1973). (In German).

1 fig.; 3 refs.

A polycarbonate membrane filter system, which acts as a sieve filter, is described. Special methods of production (bombardment with the radiation from a nuclear reactor followed by defined etching) make it particularly suitable for the selective separation of microparticles. In this filter system, the parameters essential to membrane filters, such as diameter and density of voids, are exactly reproducible values, which can be measured by electron-optical methods at any time. (DE)

15355 IMPROVEMENT OF THE TIME-DEPENDENT CREEP STRENGTH OF DIRECTED SOLIDIFIED SOLID SOLUTIONS OF THE COTAC TYPE BY CARBIDE PRECIPITATION. Trottier, J. P.; Khan, T.; Stohr, J. F.; Rabinovitch, M.; Bibring, H. (Office National d'Etudes et de Recherches Aerospatiales (ONERA), 92 – Chatillon (France)). Kobalt; No. 3, 52-58(1974). (In German).

11 figs.; 3 tabs.; 15 refs.

A cobalt based matrix can be strengthened by TaC fibers, which occur in the material by directed solidification. Progress is reported on the strengthening of the matrix of these so-called COTAC alloys. Tests were performed that make use of the small solid solubility of TaC at high temperatures to a fine distributed precipitate of TaC in the matrix. Samples of COTAC-3 (Co-20Cr-10Ni-12.7Ta-0.75C) were thus solution treated at 1,300°C to effect a weak solution of the TaC fibers in the matrix and to follow, were hardened at temperatures between 700 and 1,100°C. This hardening in all cases leads to the precipitation of fine extremely stable TaC particles in the matrix and on the grain boundaries. As the fiber morphology is simultaneously in no way influenced by the solution heat treatment, unchanged fiber cross section with smooth and facet type edges, there was a considerable increase of the tensile strength and time-dependent creep strength of the solid solution for the whole investigated temperature region (800-1,100°C). Similar successes could be achieved with (Co,Cr,Al,W)-NbC-, (Co,Cr,Ni,W)-TaC-, and (Co,Cr,Ni)-(Hf,Ta)C- solid solutions. (DE)

15356 TECHNICAL REPORTS: 3RD COMPOSITES MEETING, KONSTANZ, WEST GERMANY, MARCH 28–29, 1974. Oberursel, Ger.; Deutsche Gesellschaft fuer Metallkunde (1974). 506p. (In German and English). (A-75-21901). $28.75.

The papers deal with the results of recent research work in the field of composites. Preparation methods and the various characteristics of composites are described, with particular reference to high-temperature and lightweight composites that are of paramount importance for various fields of modern technology. Composites intended for use in electrical engineering are examined, along with a family of laminated composites that are suitable for a variety of applications. The fundamentals of the technology of composites and of composite testing are considered. Two papers are in NSA scope; separate abstracts are included for them. (IAA)

For abstracts of individual papers see: 15357 and 15358.

15357 PREPARATION OF A ZrO_2–W DOUBLE FIBER-STRENGTHENED COMPOSITE WITH A SUPERALLOY MATRIX. Grundhoff, K. J.; Wirth, G.; Bunk, W. (Institut fuer Werkstoff-Forschung, Porz-Wahn, Ger.). pp 25-43 of Technical Reports: 3rd Composites Meeting, Konstanz, West Germany, March 28–29, 1974. Oberursel, Ger.; Deutsche Gesellschaft fuer Metallkunde (1974). (In German).

A survey of recent work shows that nickel-induced recrystallization of tungsten fibers has an unfavorable effect on the high-temperature creep behavior of composites employing a superalloy matrix. By in situ preparation of short oxide fibers in tungsten fibers, the tungsten structure can be effectively stabilized. In such a double-fiber composite (with superalloy matrix), the tungsten structure is resistant to high-temperature creep over long periods of time. Techniques used to prepare oxide-fiber-strengthened tungsten fibers and to imbed the fibers in a superalloy matrix are described. (IAA)

15358 INVESTIGATIONS CONCERNING THE BOND STRENGTH IN METAL/CERAMICS COMPOSITE-LAMINATE SYSTEMS. Elssner, K. D.; Moergenthaler, K. D.; Pabst, R. (Max-Planck-Institut fuer Metallforschung, Stuttgart). pp 415-431 of Technical Reports: 3rd Composites Meeting, Konstanz, West Germany, March 28–29, 1974. Oberursel, Ger.; Deutsche Gesellschaft fuer Metallkunde (1974). (In German).

Attention is given to the determination of the bond strength between ceramic material and metal in the model system Al_2O_3/Nb/Al_2O_3. The bonding procedure used involved a welding process in high vacuum. In the welding process temperatures in the range from 1400 to 1800°C were used. The effect of welding and microstructure parameters on conventional bond strength and on the fracture resistance of the bond was studied, taking into account conditions in the case of notched and unnotched tensile and bending test specimens. (IAA)

15359 KINETICS OF BORON DEPOSITION BY THE HYDROGEN REDUCTION OF BORON TRICHLORIDE. Mehalso, R. M.; Diefendorf, R. J. (Rensselaer Polytechnic Inst., Troy, NY). pp 84-98 of Chemical Vapor Deposition. Blocher, J. M. Jr.; Hintermann, H. E.; Hall, L. H. (eds.). Princeton, NJ; The Electrochemical Society, Inc. (1975).

From 5th international conference on chemistry vapor deposition; Burkinghamshire, UK (21 Sep 1975). See CONF-750991-.

The chemical vapor deposition of boron filament is generally considered to be limited by the diffusion of the reactive species to the hot substrate. From concentration gradient considerations and from experimental measurements, it is concluded the product

species (HCl) is more likely to be involved in limiting the deposition rate. Comparison of theoretically calculated and experimentally measured deposition rates show that the rate is generally partially limited by diffusion and partially by the surface reaction rate (desorption) of HCl. The relative amounts of surface reaction or diffusion rate impedance were determined as a function of temperature and gas velocity. The temperature coefficient for the desorption of HCl was found to be 52 kcal/mole. (auth)

15360 MECHANISM OF PYROCARBON FORMATION FROM PROPYLENE. Gower, R. P.; Hill, J. (Atomic Weapon Research Establishment, Aldermaston, Eng.). pp 114-129 of Chemical Vapor Deposition. Blocher, J. M. Jr.; Hintermann, H. E.; Hall, L. H. (eds.). Princeton, NJ; The Electrochemical Society, Inc. (1975).

From 5th international conference on chemistry vapor deposition; Burkinghamshire, UK (21 Sep 1975). See CONF-750991-.

The pyrolysis of propylene was investigated at 100 mm Hg pressure over a carbon filament heated to 1000–1400°C. The major products of reaction were carbon and hydrogen together with methane, ethylene, and acetylene. Large quantities of tars were also formed as by-products. The tars consist of polynuclear aromatic hydrocarbons. Disappearance of propylene was first order with E/sub A/ equals 4.8 kcal mole^{-1} and a pre-exponential factor (A) of 3.5×10^9 s^{-1}. The rate of rise of vessel pressure gave similar results (E/sub A/ equals 6.4 kcal mole^{-1}; A equals 4.1×10^9 s^{-1}). Results suggest activation of propylene at the surface is the rate determining step followed by the formation of the propenyl radical (C_3H_5). The variation of the concentrations of hydrocarbons in the gas phase with time is cyclic and it is concluded that opposing the formation reactions are other reactions such as formation of pyrocarbon at the filament. Formation of methane and ethylene have activation energies of 12 and 5 kcal mole^{-1} respectively while the removal of these gases has activation energies of 2 and approximately zero. Physical adsorption is suggested as the removal step. The formation of pyrocarbon has E/sub A/ approximately 20 kcal mole^{-1}, suggesting a reaction via formation of tars on the filament surface or one in which surface diffusion is rate determining. Pyrocarbon produced from propylene is well ordered, indicating the occurrence of a mesophase and supporting a formation mechanism involving tars. (auth)

15361 BORONIZING AND THE DEPOSITION OF LAYERS CONTAINING BORON BY THE CVD PROCESS. Bonetti, R.; Comte, D.; Hintermann, H. E. (Laboratoire Suisse de Recherches Horlogeres, Neuchatel, Switzerland). pp 495-508 of Chemical Vapor Deposition. Blocher, J. M. Jr.; Hintermann, H. E.; Hall, L. H. (eds.). Princeton, NJ; The Electrochemical Society, Inc. (1975).

From 5th international conference on chemistry vapor deposition; Burkinghamshire, UK (21 Sep 1975). See CONF-750991-.

Two systems were investigated, the thermal decomposition of metal borohydrides to obtain layers containing boron, and the hydrogen reduction of boron halides for the boronizing of metals. The thermal decomposition of $Ti(BH_4)_3$, $Al(BH_4)_3$ and $Zr(BH_4)_4$ has been studied with the aim to deposit hard, boron-containing coatings. At deposition temperatures below 500°C the coatings produced are amorphous and electrical conductors. The coatings with the best properties were those deposited onto fused silica from $Ti(BH_4)_3$. Hard, uniform coatings with a good adherence were obtained on Ti and W wires heated by passing a current through them to temperatures above 800°C when using all of the borohydrides. A description is given of the CVD-boronizing process for different metals and alloys when using H_2BCl_3 and H_2/BBr_3. Of the different process parameters studied, the deposition temperature and the substrate composition were found to have the most influence on the reaction, and the nature and properties of the diffusion layer. The structure, thickness, hardness, roughness and tribological properties of the coatings produced are described. (auth)

15362 FACTORS AFFECTING THE MICROSTRUCTURE OF PYROLYTIC CARBON COATINGS ON NUCLEAR FUEL PARTICLES. Guilleray, J.; Lefevre, R. L. R.; Price, M. S. T.; Thomas, J. P. pp 727-748 of Chemical Vapor Deposition. Blocher, J. M. Jr.; Hintermann, H. E.; Hall, L. H. (eds.). Princeton, NJ; The Electrochemical Society, Inc. (1975).

From 5th international conference on chemistry vapor deposition; Burkinghamshire, UK (21 Sep 1975). See CONF-750991-.

Chemical vapor deposition played an important part in development of fuel for HTR. The fuel is in the form of small spherical coated particles dispersed in a graphite matrix. The multilayer coating on the particles is to contain the fission products; the preferred coating materials are pyrolytic carbon and silicon carbide. A charge of particles is fluidized in a heated graphite chamber by a flow of gas. The geometries of the chamber and the injector(s) are chosen to produce a generally spouting mode of fluidization and thereby recycle the particles. To deposit a coating of pyrolytic carbon on the particles, a hydrocarbon is introduced as part of the fluidizing gas and a reaction zone temperature in the range 1200–2000°C is used. The hydrocarbon decomposes and the eventual products of the chain of processes are carbon and hydrogen. Recirculation of the particles leads to deposition of pyrolytic carbon on the particles. Although theoretically the gas composition can be adjusted so that there is no net thermal contribution by the gas mixture, this has not yet been the criterion governing the choice of hydrocarbon. Thus, except for some mixtures containing acetylene as source gas, the thermal contribution by the fluidizing gas mixture is always negative. The coating process is complex; further complexity also stems from the vast spectrum of structural arrangements which can occur in carbon deposits. Differences in the behavior of pyrolytic carbon under fast neutron irradiation have been observed, and some coatings derived from methane appear to have insufficient ductility in service. Several lines of investigation were undertaken to improve the knowledge of the factors affecting the microstructure of pyrocarbon on nuclear fuel particles. First a series of studies was carried out on model fluidized beds, leading to the development of a radioactive particle tracer technique which was applied to practical fluidized beds. It was recognized that advances were unlikely to be made unless a simple model of the whole process of pyrocarbon deposition was developed. A basic requirement of such a model was that it should be capable of being tested. Experiments were also carried out to examine the sensitivity of the microstructure to input parameters. This paper gives a brief introduction to these investigations, prior to reporting on new experiments designed to study microstructure control in pyrocarbon coatings. Systematic variations of particle density, particle diameter, nature of the hydrocarbon and fluidizing gas composition were made and these are related to the resultant microstructures. (DLC)

15363 POLY(BUTENE-1 SULFONE)–A HIGHLY SENSITIVE POSITIVE RESIST. Bowden, M.J.; Thompson, L.F.; Ballantyne, J.P. (Bell Laboratories, Murray Hill, New Jersey 07974). J. Vac. Sci. Technol. 12: No. 6, 1294-1296 (Nov 1975).

The positive electron resist poly(butene-1 sulfone) (PBS) has been reported previously. As with other electron resists, sensitivity has been shown to be dependent on a number of processing parameters such as accelerating voltage, developer, developer solvent, and polymer characteristics (namely, molecular weight, molecular weight distribution, etc.). Previous reports have involved resist samples and conditions resulting in sensitivities within the range of $4–6 \times 10^{-6}$ C/cm^2 at 10 kV. For certain uses, for example, on the Bell Laboratories electron beam exposure system (EBES), a sensitivity of better than 1×10^{-6} C/cm^2 at 10 kV is desired for efficient operation. Recent studies involving samples of varying molecular parameters verify feasibility of sensitivities of $7–8 \times 10^{-7}$ C/cm^2 at 10 kV for carefully controlled molecular weight and molecular weight distribution. As expected, processing of PBS at this sensitivity requires careful attention to polymer dissolution mechanisms. An ideal developing system should dissolve the irradiated region while hardly swelling the unirradiated region. This requires a developing solvent to be kinetically poor but thermodynamically good. Swelling and loss of resolution can occur when these conditions are not fulfilled. (auth)

15364 PHOTOLUMINESCENCE MEASUREMENT OF ION-ETCHED GaAs SURFACE. Namba, S.; Kawabe, M.; Kanzaki, N.; Masuda, K. (Faculty of Engineering Science, Osaka University, Toyonaka, Japan). J. Vac. Sci. Technol. 12: No. 6, 1348-1351 (Nov 1975).

The effects of ion etching and annealing of GaAs were studied by observing photoluminescence, reflectance, and electron diffraction patterns. The (100) surfaces of GaAs were rf sputter etched. The intensity of the edge emission decreased to about 1/15 of the initial value in the case of a Si-doped sample when excited by a He–Cd laser (3250 Å) at 10 K. The depth of the damaged layer is deduced to exceed the bombarding ion range. Annealing increased the edge emission intensity up to the temperature of 450°C, above which edge emission decreased due to thermal dissociation. On the other hand, electron diffraction patterns and reflection spectra showed continuous recovering of lattice ordering above the annealing temperature of 450°C. (auth)

15365 CHANNELING ION IMPLANTATION THROUGH PALLADIUM FILMS. Ishiwara, H.; Furukawa, S. (Department of Physical Electronics, Faculty of Engineering, Tokyo Institute of Technology, Meguroku, Tokyo 152, Japan). J. Vac. Sci. Technol. 12: No. 6, 1374-1377 (Nov 1975).

The possibility of channeling ion implantation into semiconductors through polycrystalline metallic layers is studied. Minimum values and

standard deviations of channeling angular yield in polycrystalline Pd_2Si layers formed on Si have been measured by protons and ^4He, and ^{14}N ion backscattering and channeling measurements. Depth distributions of the spread of crystallite orientations and scattering centers such as lattice defects have been separately derived by using the above two quantities. It has been concluded that the channeling-ion-implantation technique will become a practical one by using the parallel scanning system. (auth)

NUCLEAR MATERIALS AND WASTE MANAGEMENT

Accountability and Safeguards

Refer also to abstracts 14256 and 14987.

15366 (SAND-75-6068) PROTECTING PLUTONIUM: PHYSICAL SAFEGUARDS. Ney, J. F. (Sandia Labs., Albuquerque, N. Mex. (USA)). Oct 1975. 24p. (CONF-751055-1). Dep. NTIS $4.50.

From AIF workshop on the nuclear debate: basic issues for 1976; Boston, Massachusetts, USA (29 Oct 1975).

In the development of physical protection systems, objectives for improving overall performance include the following: (1) Increase the time required for the malefactor to achieve his goal; (2) decrease the time required for detection of malevolent activities; (3) reduce the time for adequate response force arrival; (4) increase the capability to neutralize the malefactor; (5) reduce the total protection system costs, while increasing the level of protection; (6) improve acceptance levels (social, environmental, legal, and institutional); and (7) increase nuclear fuel cycle safety. Fortunately, there is sufficient lead time and technical base to explore and develop new protection system concepts so that a completely integrated and tested protection system capable of providing unprecedented levels of security can be available when needed. Although it will be impossible to completely eliminate all risks, it should be both possible and economically feasible to install protection systems which will deter or prevent a malefactor from using the nuclear fuel cycle to disrupt society. (auth)

15367 CHEMICAL ANALYSIS OF NUCLEAR FUELS. von Baeckmann, A. H. E. (International Atomic Energy Agency, Vienna (Australia)). KFK Nachr.; 7: No. 2, 33-35(Jul 1975). (In German).

4 figs.; 3 refs.

Apparatuses and methods used at Karlsruhe Nuclear Research Center for the analysis of nuclear fuels are surveyed. The analytical tasks comprise the whole fuel cycle, from the analysis of unirradiated nuclear fuels to irradiated fuels and the chemical characterization of radioactive wastes. The reliability of the analytical findings, especially of the routine procedures, is often studied in international laboratory comparisons. This applies mostly to methods used in the fissile materials safeguard system. (DE)

Disposal and Storage

Refer also to abstracts 14350 and 14830.

15368 (ANL-75-64) ANNUAL REPORT ON DWMT PROJECT AN0115A, FY 1975. Fried, S. M.; Friedman, A. M.; Hines, J. J.; Quarterman, L. A. (Argonne National Lab., Ill. (USA)). Sep 1975. Contract W-31-109-Eng-38. 14p. Dep. NTIS $4.50.

Migration of Pu and Am in rocks and soils were studied using computer and laboratory-scale models. Surface absorption coefficients of Am were measured on tuff. (DLC)

15369 (BNL-20779) TRITIUM STORAGE DEVELOPMENT. Progress Report No. 5, July–September 1975. Colombo, P.; Steinberg, M.; Manowitz, B. (Brookhaven National Lab., Upton, N. Y. (USA)). Nov 1975. 37p. Dep. NTIS $4.00.

Various prospective cement concrete formulations for tritium immobilization were analyzed thermogravimetrically (TGA) to allow their behavior in a thermal environment relative to tritium release to be ascertained. Curing exotherms of large neat cement castings were found to be appreciable. Methods are discussed to decrease these exotherms. Process development for large-scale cement castings has continued. Equipment was received to allow the development of a drum tumbler mixing technique to be initiated. (auth)

15370 (BNWL-1940) PROGRAM PLAN FOR COMPREHENSIVE CHARACTERIZATION OF SOLIDIFIED HIGH-LEVEL WASTES. Mendel, J. E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Dec 1975. Contract E(45-1)-1830. vp. Dep. NTIS $5.45.

An experimental plan is described for in-depth characterization of canistered solidified waste forms for the storage and disposal of high-level radioactive wastes. The plan is being considered for silicate glass forms at PNL. The basic aspects of the plan have general application and can be applied to other candidate waste forms as well. The plan is designed to define the behavior of waste canisters and their contents during anticipated handling, storage, and disposal regimes. Particular emphasis is placed on long-term thermal and radiation effects. A 10-year period is projected for complete characterization of any one basic type of waste form, e.g., silicate glass cast in metal canisters. A preponderance of the laboratory effort occurs in the first 5 years. It is assumed that shortly thereafter an operating solidification plant will be available, so that much of the second 5 years can be devoted to corroborative tests made on representative canisters of actual high-level waste. Manpower requirements are estimated at 65 scientist man-years during the first 5 years and 30 scientist man-years during the second 5 years. (auth)

15371 SAFETY ASPECTS OF SINKING RADIOACTIVE WASTE INTO THE SEA. Hunzinger, W. Meerestechnik; 6: No. 1, 23-27(Feb 1975). (In German).

3 tabs.; 7 refs.

The problem of disposing of noxious materials in the North Atlantic, considering the chemical-physical processes which could prevent their re-entry into the cycle of our biosphere, is considered. (DE)

Handling Equipment and Procedures

Refer also to abstract 16437.

15372 (AWRE-O-37/75) STUDY OF THE VALIDITY OF THE MONK COMPUTER PROGRAM FOR CRITICALITY ASSESSMENT WORK. Parker, C. (UKAEA Weapons Group, Aldermaston. Atomic Weapons Research Establishment). Nov 1975. 44p. Dep. NTIS (US Sales Only) $4.00. UK £1.00.

The errors in k obtained from the Monte Carlo neutronics code MONK were studied. These fall into two groups, i.e., those inherent in the statistics of the Monte Carlo method and those arising from the nuclear data and its treatment in the program. In the study of the statistical nature of MONK, two methods of calculating k were compared, the drift in k was discussed and the reproducibility of results was investigated. The study of the nuclear data treatment showed discrepancies of up to 7% when comparison was made with known critical size data. These discrepancies were found to depend on the mean energy of the neutrons causing fission. They are much larger than the differences in k obtained from a range of nuclear data sets. A method is suggested whereby these discrepancies could be minimized. It is concluded that MONK is a satisfactory code for nuclear safety assessment work, provided that its results are used with caution and that the user has an understanding of the underlying nuclear physics. Some modifications have been made to MONK as a result of this work. (auth)

15373 (CNLM-536) PROPOSAL FOR COMBINED HOT LABORATORY AND RADIOACTIVE WASTE HANDLING FACILITY FOR CANEL. (Pratt and Whitney Aircraft, Middletown, Conn. (USA)). 10 Feb 1958. 24p. Dep. NTIS $3.50.

A detailed re-evaluation of hot laboratory and radioactive waste handling requirements based on the current approved research and development program for CANEL was carried out. The study indicated that it is feasible, practical and economic to combine the two facilities. A revised design of the hot laboratory, incorporating the radioactive waste handling facility, was prepared. The number of hot cells was reduced. A change in the waste handling philosophy resulted in halving the size of the retention tank system and eliminating all pipe tunnels. This reflects the maximum possible economies which can be effected and still produce a minimum workable facility. Rough cost estimates for the combined facility are presented. Construction schedules were estimated based upon obtaining approval to proceed by March 15, 1958. These indicate that construction and equipment setup and shakedown can be completed and the facility can become operational sometime between March 1 and December 1, 1960. The facility operational data depends upon the manner in which the contract work is handled. Equipment requirements including cost estimates are presented. (auth)

15374 (CNLM-3924) CANEL HOT CELL FACILITY. (Pratt and Whitney Aircraft, Middletown, Conn. (USA)). 1962. Contract AT(30-1)-2789. 16p. Dep. NTIS $3.50.

The CANEL hot laboratory became operational in August 1960. The hot laboratory group performs all of the irradiated experiment disassembly, radiochemistry, radiometallurgy, and radiometric and mass spectrometric gas analysis for CANEL. In

addition, the group provides all liquid and solid radioactive waste treatment, hot laundering, and decontamination services for the site. The hot laboratory equipment, capabilities, and operating experience are discussed. (auth)

15375 FERNBEDIENUNGSGERAETE ZUM ARBEITEN HINTER SCHUTZWAENDEN. Parallel-Manipulatoren mit 3 Gelenken, Masse. (Remote Handling Devices for Use Behind Shielding Walls. Master-Slave Manipulators with Three Hinges, Dimensions). Berlin, F. R. Germany; Beuth (Nov 1974). 4p. (In German). (DIN-25409(Bl.2)).

Dimensions of manipulators with 7 independent movements are given. (DE)

15376 FERNBEDIENUNGSGERAETE ZUM ARBEITEN HINTER SCHUTZWAENDEN. Ferngreifer, Masse. (Remote Handling Devices for Use Behind Shielding Walls. Remote Handling Tongs, Dimensions). Berlin, F. R. Germany; Beuth (Nov 1974). 2p. (In German). (DIN-25409(Bl.1)).

5 figs.; 6 refs.

Dimensions of removable equipment with plug lead-in holes are given. (DE)

15377 FERNBEDIENUNGSGERAETE ZUM ARBEITEN HINTER SCHUTZWAENDEN. Parallel-Manipulatoren in Teleskopbauart, Masse. (Remote Handling Devices for Use Behind Shielding Walls. Telescopic Master Slave Manipulators, Dimensions). Berlin, F. R. Germany; Beuth (Nov 1974). 3p. (In German). (DIN-25409(Bl.3)).

4 figs.

The standardized general dimensions as recommended in this standard will facilitate the planning and construction of shielding rooms in which master-slave manipulators as specified in this standard are to be used, as well as the interchangeability of these instruments. It will also help to shorten the time of delivery in the initial supply of master-slave manipulators for these rooms and in the supply of replacement parts. (DE)

Transportation

Refer also to abstract 14830.

15378 (ANL-Trans-1025) PACKAGING FOR THE TRANSPORT OF IRRADIATED FUEL FROM FAST NEUTRON REACTORS. Labrousse, P. M.; Lucas, H. Translated from Bull. Inf. Sci. Tech. (Paris); No. 190, 47-54(Mar 1974). 20p. Dep. NTIS $3.50.

Because of the treatment of Rapsodie and Fortissimo fuel pins, irradiated in Cadarache, in La Hague, the CEA has some experience in the transport of irradiated fuel from fast breeder reactors. After a brief description of IU07 packaging designs used for this purpose, the article discusses the problems raised by the transport of Phenix reactor fuel pins and the options selected for the construction of IU11 packaging. The progress of the first studies carried out for the transport of Super Phenix assemblies is indicated in detail. (auth)

15379 (RDT-F-7-2T(Amend.1)(1-5-76)) PREPARATIONS FOR SEALING, PACKAGING, PACKING, AND MARKING OF COMPONENTS FOR SHIPMENT AND STORAGE. Amendment 1. (Energy Research and Development Administration, Washington, D.C. (USA). Div. of Reactor Research and Development). 5 Jan 1976. 4p. RSO.

The amendment consists of pages 13 and 14 of RDT-F-7-2T. An editorial change has been made in paragraph 6.1.1. (TFD)

15380 (SAND-76-5039) FULL SCALE VEHICLE TESTING PROGRAM. Yoshimura, H. R. (Sandia Labs., Albuquerque, N. Mex. (USA)). Jan 1976. 24p. (CONF-760104-3). Dep. NTIS $3.50.

From annual meeting of the transportation research board; Washington, District of Columbia, USA (19 Jan 1976).

Sandia Laboratories has been requested by ERDA to conduct a series of spent fuel shipping cask accident tests to evaluate the ability of large shipping casks (22.7 x 10^3 to 66.0 x 10^3 kg range) (25 to 75 ton) to maintain integrity under extremely adverse environments. This paper describes the three proposed accident scenarios and the development of an experimental program to measure cask impact parameters. Two railroad equipment and one motor truck accident tests will be conducted. Analytical studies and scale model tests will be performed for each accident test. Engineering measurements will include photometric coverage to show rigid body motion and deformation and measurement of acceleration and strain in the cask and vehicle. (auth)

15381 AMERICAN NATIONAL STANDARD GUIDE TO DESIGN AND USE OF SHIPPING PACKAGES FOR TYPE A QUANTITIES OF RADIOACTIVE MATERIALS. ANSI N14.7-1975. New York; American National Standards Inst., Inc. (1975). 24p. (ICONS-02088).

The standard provides guidance for persons responsible for activities involving the packaging of radioactive materials in Type A quantities, except for quantities of fissile materials in excess of the package limits set forth in Appendix A, when such packages are to be delivered to a carrier for transport. It covers criteria for design of new Type A packagings and for qualifying prototypes to performance standards. It covers the preparation and tests or inspections of Type A packages, whether new or returned for reuse, including associated document requirements. It also includes illustrative and explanatory information to enrich shippers' understanding of the reasons for certain standard requirements, where appropriate. (auth)

15382 METHOD FOR DECREASING RADIATION HAZARD IN TRANSPORTING RADIOACTIVE MATERIAL. Wodrich, D. D. (to Atlantic Richfield Co.). US Patent 3,917,953. 4 Nov 1975. Filed date 3 Apr 1974. 10p.

At the end of their useful life, fuel rods are removed from a nuclear reactor and transferred underwater into a shipping cask. The water in the pool of the nuclear reactor system (or fuels reprocessing plant) may contain troublesome amounts of radioactive isotopes, creating biological hazards for any shipping cask unless adequately cleaned after contacting pool water. Potential contamination of substantially all of the entire exterior of the shipping cask is avoided because such shipping cask is at least predominantly immersed in fresh water within a vertically shiftable container which can be, for example, shifted between the bottom and the surface of the pool. Fresh water is supplied to the interior of the shiftable container whereby substantially all of the exterior of the shipping cask is immersed in fresh water, maintained at a pressure and/or flow velocity preventing the pool water from contacting the exterior of the shipping cask. (auth)

15383 A JOINT FOR CONNECTING RADIATION-SHIELDING ELEMENTS. (to NL Industries, Inc.). French Patent 2,227,604/A/. 21 Apr 1973. 12p. (In French)

Description is given of a joint for connecting radiation-shielding elements end-to-end, characterized in that the joint is located between the adjacent end-portions of parts of reduced thickness of the shielding elements and that it comprises a plurality of filling elements and of weld-elements connecting the latter to the adjacent end-portions of the radiations-shielding elements. (FR)

15384 TRANSPORT SYSTEM FOR RADIOACTIVE MATERIALS. Heller, M.; Kaetscher, E.; Weber, R. (to Kraftwerk Union A. G., Muelheim an der Ruhr (F. R. Germany)). German (FRG) Patent 2,359,114/A/. 28 May 1975. 9p. (In German)

The transport system for radioactive materials such as unirradiated plutonium elements (Type-B-Classification of the IAEA Regulations for the safe Transport of Radioactive Materials) consists of a mechanically strong cylindrical transport container for fuel elements of nuclear reactors (Type-A-Classification) enclosed in a double-wall safety container. The walls of the safety container are made of sheet steel (e.g. ductile sheet steel St 37-2 as in DIN 1541). The intermediate spaces are filled with heat insulating material such as rock or asbestos wool. Bracings are installed between the transport and safety containers. On the four corners of the safety container there are vertical supports which are connected to horizontal supports running along the bottom side. The top side of the safety container is developed as a cover. (DE)

PARTICLE ACCELERATORS

Design, Development, and Operation

Refer also to abstract 15575.

15385 (INIS-mf-1734) McMASTER UNIVERSITY NUCLEAR SCIENCE RESEARCH REPORT. (McMaster Univ., Hamilton, Ontario (Canada)). Jan 1975. 190p. INIS.

A summary is given of the research carried out at McMaster University in the field of nuclear science during 1974. The introductory chapter briefly outlines the history of nuclear science at the university and describes the nuclear reactor and the tandem Van de Graaff accelerator around which the program has developed. Progress reports from the research groups using these facilities are presented, followed by reports on reactor and accelerator operations. (auth)

15386 (INIS-mf-1756) ANNUAL REPORT OF THE LAVAL UNIVERSITY VAN DE GRAAFF LABORATORY, 1974. (Laval Univ., Quebec City (Canada). Dept. de Physique). Nov 1974. 80p. (In French). INIS.

The activities of the Laval University Van de Graaff Laboratory are outlined for the period from December, 1973, to November, 1974. The operating record of the accelerator was good, and heavy ion acceleration was increasingly stressed. Additional software has increased the value of the PDP-9 computer for data acquisition and the PDP-15 for data analysis. Research programs in nuclear and solid-state physics are described. (INIS)

15387 (LA-6109-PR) MEDIUM-ENERGY PHYSICS PROGRAM PROGRESS REPORT, FEBRUARY 1–APRIL 30, 1975. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1975. Contract W-7405-eng-36. 110p. Dep. NTIS $5.45.

Operation, modifications, and research efforts at the Clinton P. Anderson Meson Physics Facility (LAMPF Linac) are reported. A large maintenance effort was made in cleaning and upgrading the rf system, and numerous improvements were made in the beam injection, monitoring, and transport systems. Advancements were made on beam dynamics problems, and optics calculations and design studies resulted in a number of hardware improvements. The major accomplishment of the reporting period was the completion of the shimming and the mapping of the Energetic Pion Channel and Spectrometer (EPICS). Current and future experimental work is described. (PMA)

15388 (UCID-16746) PRELIMINARY STUDIES ON ACCELERATOR DEVELOPMENT PROGRAM. Reginato, L. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 3 Apr 1975. Contract W-7405-Eng-48. 11p. Dep. NTIS $3.50.

A study was made of the Abramyan type accelerator using a scale model to investigate the resonant transformer principle and the beam induced voltages. The Abramyan technique of resonant transformer charging an accelerating gap was found to work very well. The circuit is quite simple, the components values are not critical, and only a low voltage primary capacitor and a single switch are needed to generate a high secondary voltage. (PMA)

15389 HIGH-POWER PULSE-TYPE ACCELERATOR WITH RIBBON-SHAPED ELECTRON BEAM. Bevov, R. K.; Mezhevov, V. S.; Smakovskii, Yu. B.; Strel'tsov, A. P. Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 697-699(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 34-35(1975).

An accelerator with electron beam cross section of 2×26 cm is described. Oscillograms of accelerating voltage and electron current are presented. Electron current is 26 kA with a risetime of 4×10^{-9} sec and pulse duration of 3.5×10^{-8} sec. Electron energy is ~300 keV. (auth)

15390 PULSED ELECTRON ACCELERATOR. Volovik, V. D.; Gaiduk, K. Ya.; Zalyubovskii, I. I.; Chernyi, V. V. (Kharkov State Univ.). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 700-701(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 36-37(1975).

An electron accelerator is described that is based on an Arkad'ev-Marx generator in the form of a symmetric strip line. This makes it possible to obtain a current pulse in the diode of approximately 20 nsec duration without additional shaping. The maximum electron energy is 1.2 MeV and the beam current is 3 kA. (auth)

15391 ELECTRON ACCELERATORS WITH A PLASMA INJECTOR AND BEAM EXTRACTION INTO ATMOSPHERE. Belyuk, S. I.; Gruzdev, V. A.; Zherdev, Yu. I.; Kaz'min, G. S.; Koval'chuk, B. M.; Kreindel, Yu. E.; Mozgunov, K. A.; Filonov, A. G.; Shchelokov, A. V. (Inst. of Automated Control and Radioelectronic Systems, Tomsk, USSR). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 692-694(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 30-32(1975).

High-voltage accelerators with a plasma electron source using a reflected discharge in a magnetic field and beam extraction into the atmosphere are described. (auth)

15392 ACCELERATION OF BERYLLIUM IONS IN A CYCLOTRON. Venikov, N. I.; Unezhev, V. N.; Chumakov, N. I. Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 683-684(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 24-25(1975).

Be^{2+} and Be^{3+} ions were accelerated up to energies of 26 and 54 MeV for an external beam intensity of 2 and 0.3 μA, respectively, in the cyclotron at the Atomic Energy Institute. (auth)

15393 THE 590 MeV ISOCHRONOUS RING CYCLOTRON OF THE SWISS INSTITUTE OF NUCLEAR RESEARCH (S.I.N.). Joho, W. (Schweizerisches Inst. fuer Nuklearforschung Villigen); Brunner, A. Kerntechnik; 17: No. 8, 345-350(Aug 1975).

7 figs.; 5 refs.

In January and February, 1974, the Swiss Institute of Nuclear Research (S.I.N.) successfully commissioned its isochronous cyclotron for 590 MeV protons. This cyclotron is thus the second operating accelerator of a series of three meson factories, and is the only one of its kind in Europe. During the spring and summer of 1974, the first experiments with pions produced from an external target were performed. During the spring of 1975, an extracted beam current of 25 μA was obtained, and transmission through the cyclotron was brought to values of 90 to 95%. (DE)

15394 CHARGED PARTICLE ACCELERATION WITH INTENSE RELATIVISTIC ELECTRON BEAMS. Straw, D. C.; Miller, R. B. (Air Force Weapons Labs., Kirtland, AFB, NM). pp 482-496 of Electron and Ion Beam Science and Technology. Bakish, R. (ed.). Princeton, NJ; Electrochemical Society, Inc. (1974).

From 6th international conference on electron and ion beam science and technology; San Francisco, California, USA (12 May 1974). See CONF-740515-.

Results are reported for experiments in collective ion acceleration designed to assess the validity of a recent theoretical model and to find ways of enhancing the ion acceleration mechanism. Efforts were concentrated on varying the space charge limiting current and the type and pressure of the background neutral gas. Changes in the space charge limiting current, produced by varying the beam and drift tube radii, caused changes in the ion beam energy by over three orders of magnitude. (PMA)

15395 ATRI—A TESLA-TRANSFORMER-TYPE ELECTRON-BEAM ACCELERATOR. Boscolo, I.; Brautti, G.; Leo, M.; Luches, A.; Perrone, M.R. (Istituto di Fisica, Università di Lecce, Lecce, Italy). J. Vac. Sci. Technol. 12: No. 6, 1194-1196 (Nov 1975).

An electron-beam transformer accelerator is described. Its high voltage terminal rises up to 1.2 MV with an input voltage of 18 kV. The maximum electron-beam current is 16 kA; the pulse length is about 20 nsec. Aluminized Mylar anodes and foilless anodes are used. With foilless anodes the repetition rate is at present 3 pulses/sec. Pulse shape details are given and discussed to understand the behavior of the machine and its output characteristics. An improvement program is also presented. (auth)

Auxiliaries and Components

Refer also to abstracts 14614, 14752, and 14980.

15396 (CEA-N-1809) STUDY OF THE BEAM OF THE 60 MeV LINAC AND AUTOMATION OF THE ACCELERATOR OPERATION. Roland, S. (CEA Centre d'Etudes Nucleaires de Saclay, 91- Gif-sur-Yvette (France). Dept. de Physique Nucleaire; Paris-11 Univ., 91-Orsay (France)). Jul 1975. 139p. (In French). INIS.

The on-line automation of a Linac depends essentially on a very extensive use of measuring and control devices. In particular, peak currents from 15 mA to 6 A and pulses from 2 μs to 6 ns respectively are continuously monitored by ferrite transformers at the end of each section. A special study of low intensity beams (of the order of 0.1 μA) was also made by means of transition radiation phenomena which produce visible radiation whenever an electron beam traverses thin metallic foils (5μ). Thus electron energies, beam profile position, and energy as well

as pulse widths were measured by appropriately adapted detectors. A precise knowledge of the behavior of the above beam characteristics then enable a linac stability of the order of 1% over periods of several weeks. (FR)

15397 (CERN-75-17) . CALCULATION AND OPTIMIZATION OF STRAY FIELDS OF SEPTUM DIPOLE MAGNETS. Holmes, A. J. T. (European Organization for Nuclear Research, Geneva (Switzerland)). 26 Nov 1975. 22p. Dep NTIS (US Sales Only) $3.50.

A theoretical treatment is described of the external stray field of C-shaped septum magnets, such as those designed for the beam extraction systems of the 400 GeV CERN Super Proton Synchrotron. A special conformal transformation of the magnetic plane yields analytic expressions for the four components of the stray field: (1) the septum-shape field (due to the form of the septum conductor); (2) the edge-effect field (due to the mechanical clearance between septum and yoke); (3) the cooling-duct field (due to the presence of these ducts in the septum); and (4) the magnetomotance field (caused by the ampere-turn losses in the yoke). These expressions can be computed by numerical iteration. The septum-shape field turns out to be opposite in sign to the other three, making possible a criterion which creates a minimal stray field for a given magnetic induction. Plots of calculated and measured stray fields are presented for four prototype septum magnets whose total induction is between 0.38 and 1.41 T. (auth)

15398 (ERDA-tr-86, pp 17-24) PULSED SUPERCONDUCTING MAGNETS. Turowski, P. (Institute for Experimental Nuclear Physics, Karlsruhe, Ger.). Jan 1975. Translated from German Report.

In reports of the Nuclear Research Center, Karlsruhe. 7th annual publication.

Details of the status and current problems of a pulsed superconducting magnet program are given. An additional heat source in pulsed magnet operation is due to hysteresis and eddy current losses, causing difficulties in magnets for high energy particle accelerators. A dipole magnet was constructed to investigate possible loss reductions, and its operation, design, and performance are discussed. (PMA)

15399 (JINR-9-8270) DESIGNED CHANNELS FOR MUON BEAMS IN A PHASOTRON WITH A MAGNETIC FIELD VARIATION. Dem'yanov, A. V.; Dzhelepov, V. P.; Zamolodchikov, B. I.; Kropin, A. A.; Roganov, V. S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 27p. (In Russian). INIS.

14 refs.; 4 figs.; 6 tables.

A description is given of channels I and X of a high-current, phasotron design (unit "ϕ"), which will be used to obtain pure muon beams. Data are presented on the expected intensities of the beams (including pion beams) which can be formed in channels I and X. (tr-auth)

15400 (KFK-2194) SUPERCONDUCTING NIOBIUM ACCELERATOR STRUCTURES FOR A PROTON LINEAR ACCELERATOR FROM 200 TO 600 MeV. Bauer, W.; Mittag, K. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Experimentelle Kernphysik). Sep 1975. 77p. Dep. NTIS (US Sales Only) $5.00.

Design criteria for superconducting linear accelerator structures are reviewed, and various structures known in the literature are discussed with respect to their applicability in a 200 to 600 MeV proton linac. Using the LALA Program, several iris loaded structures were calculated and a reasonable preliminary set of parameters for a proton linac was worked out. (auth)

15401 TRANSFER MATRICES UP TO SECOND ORDER FOR THE HIGH FREQUENCY ELECTRIC DEFLECTION FIELD. Krueger, F. R. (Technische Univ. Darmstadt (F. R. Germany). Inst. fuer Kernphysik). Nucl. Instrum. Methods; 127: No. 3, 339-348(15 Aug 1975). (In German)

Transfer matrices up to second order were calculated for the electric deflection field in a parallel-plate capacitor operated at radiofrequencies and synchronized to a heavy ion accelerator. Since a straightforward calculation seemed to be impossible for this problem, certain approximations were made. Two modes of operation were considered, one being nearly "achromatic", and the other giving maximum dispersion. Relativistic corrections were considered, and the effect to first order of the fringing field and of small misalignments of the main field were included. (NL)

15402 MULTIELECTRODE ELECTRON-OPTIC SYSTEM WITH AN INDUCTIVE STORAGE DEVICE FOR A HIGH-CURRENT ACCELERATOR. Kozlov, A. A.; Maslov, A. E.; Prakhova, G. I.; Slivkov, I. N. (Scientific-Research Inst. of Opticophysical Measurements, Moscow). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 685-687(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 25-27(1975).

The circuit of an accelerator with an inductive energy-storage device and a multielectrode electron-optic system is described. The results of studying the characteristics of such a system with models are presented. The possibility of creating an electron-optic system having the properties required for an accelerator is demonstrated. (auth)

15403 INCREASING THE OPERATING RELIABILITY OF HIGH-CURRENT PULSED ACCELERATORS BY MEANS OF NONLINEAR RESISTORS. Demidov, B. A.; Ivkin, M. V.; Petrov, V. A.; Fanchenko, S. D. Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 702-704(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 37-38(1975).

A circuit for connecting the shaping line of a high-current pulsed accelerator through a nonlinear resistor is discussed. It is shown that such a method allows elimination of reverse pumpover of energy to the storage device for untimely actuation of the spark gap, which leads to prolongation of the time for which the voltage is applied, and thereby permits a substantial increase in the reliability of the high-voltage insulation. (auth)

15404 PULSED MODULATOR RATED AT A POWER OF 5 MW HAVING A HIGH REPETITION FREQUENCY. Abdul'manov, V. G.; Auslender, V. L.; Glagolev, G. B.; Panfilov, A. D.; Romashko, N. D. (Inst. of Nuclear Physics, Novosibirsk, USSR). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 705-706(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 39-40(1975).

A modulator is described having the following parameters: pulse load voltage 25 kV, pulse current 200 A, duration of the flat portion of the pulses 100 to 300 μsec, repetition frequency 50 Hz. The modulator is designed for pulsed anode supply of a vacuum-tube self-excited oscillator which excites the cavity resonator. (auth)

15405 SYSTEM FOR STABILIZING THE VOLTAGE OF ELECTROSTATIC ACCELERATORS. Almazov, A. V.; Opasin, V. V.; Myntsov, F. F. Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 707-710(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 41-43(1975).

A system with intermediate screens for stabilizing the voltage of electrostatic accelerators is described. The system is realized by means of planar corona triodes that are built into intermediate screens; these triodes eliminate the incidence of the ions in the driving triode onto the surface of the screens. The planar triodes are automatically controlled by the current of the driving triode. The efficiency of such a stabilization system is demonstrated. (auth)

15406 SPECTROGRAPH WITH SEMICIRCULAR FOCUSING FOR THE INVESTIGATION OF THE ENERGY DISTRIBUTION OF A HIGH-CURRENT BEAM OF RELATIVISTIC ELECTRONS. Gosteva, T. S.; Zablotskaya, G. R.; Ivanov, B. A.; Kolyubakin, S. A.; Chernobrovin, V. I. (Scientific-Research Inst. of Electrophysical Equipment, Leningrad). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 711-713(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 44-46(1975).

A magnetic spectrograph with semicircular focusing is described which has been designed for studying the energy distribution of an intense electron beam in the 0.2 to 3 MeV energy range on the REP-5 pulsed accelerator. (auth)

15407 PERFECTION OF A CIRCUIT FOR THE CONTROL OF IGNITRON CONVERTERS IN THE POWER-SUPPLY SYSTEM OF THE PROTON SYNCHROTRON AT THE INSTITUTE OF HIGH-ENERGY PHYSICS. Vorob'ev, V. K.; Kornakov, E. V.; Lyapichev, G. S.; Moizhes, L. L.; Radin, O. N.; Roshal, A. G.; Spevakova, F. M. (Inst. of High-Energy Physics, Serpukhov, USSR). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 677-679(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 19-21(1975).

An asynchronous system is described for control of ignitron converters, which allows the low-frequency magnetic-field pulsations to be reduced approximately by a factor of 10; the equipment for on-line determination of the harmonic components of the field pulsations which provides the possibility of measuring the amplitudes of the pulsations with an error of at most 20% is likewise described. Results are given of the functioning of the asynchronous control system which is in operation on the proton synchrotron at the Institute of High-Energy Physics. (auth)

15408 OPERATION OF A CYCLOTRON IN A DOUBLE-PULSED REGIME. Venikov, N. I.; Latushkin, S. T.; Rezvov, V. A.; Rybakov, E. I.; Unezhev, V. N.; Chumakov, N. I. Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 680-682(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 22-23(1975).

In the spectrometry of fast neutrons by the time-of-flight method on the cyclotron of the Atomic Energy Institute, a system is used which simultaneously reduces the repetition frequency of the ion bunches and their duration during multirevolution beam release. For this purpose two high-frequency deflectors are used, the first being situated on the second half-revolution of the ions inside the dee, and the second being situated in the external-beam transportation system. (auth)

15409 THE NEW hf-SYSTEM OF THE 28 GeV PROTON SYNCHROTRON AT CERN. Grassmann, H. C. (Siemens A. G., Erlangen (F. R. Germany). Geschaeftsbereich Industrie); Jankovsky, R. (Siemens A. G., Muenchen (F. R. Germany). Unternehmensbereich Bauelemente); Pirkl, W. (European Organization for Nuclear Research, Geneva (Switzerland)). Siemens-Z.; 49: No. 5, 299-306(May 1975). (In German).

12 figs.

In order to considerably increase the beam power of the 28 GeV proton synchrotron at CERN, a new hf-system was developed with extensive measuring and control devices, wide band amplifiers and accelerating units, as well as with a number of new components. (DE)

15410 STUDY ON RADIATION DAMAGE TO HIGH ENERGY ACCELERATOR COMPONENTS BY IRRADIATION IN A NUCLEAR REACTOR. Schoenbacher, H.; van de Voorde, M. (European Organization for Nuclear Research, Geneva (Switzerland)); Burtscher, A.; Casta, J. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Vienna). Kerntechnik; 17: No. 6, 268-280(Jun 1975). (In German, English).

21 figs.; 3 tabs.; 14 refs.

The structural and other components used in high energy accelerators are continuously exposed to a wide spectrum of high energy particles and electromagnetic radiation. The resulting radiation damage may severely influence the functional capability of accelerator facilities. In order to arrive at an estimate of the service life of various materials in the radiation field, simulation experiments have to be carried out in a nuclear reactor. A large number of organic and inorganic materials, electronic components, metals, etc., intended specifically for use in the 400 GeV proton synchrotron of CERN near Geneva, were irradiated in the ASTRA reactor in Seibersdorf near Vienna. A report is given on the irradiation facilities available in this reactor for this purpose, on the dosimetry methods used, on the most important materials irradiated, and on the results obtained in these experiments. (DE)

15411 15-kJ *LC* GENERATOR: LOW INDUCTANCE DEVICE FOR A 100-GW PULSED ELECTRON ACCELERATOR. Harris, N.W. (Naval Research Laboratory, Washington, D.C. 20375); Milde, H.I. J. Vac. Sci. Technol. 12: No. 6, 1188-1190 (Nov 1975).

The design and construction of a 15-kJ *LC* generator is described. This type of generator is used for its low inductance compared with more conventional Marx generators. The generator described consists of 20 capacitors rated at 80 kV, 5 reversing switches, and 1 extra-high-voltage transfer switch. The generator was built as a primary store for a high current, high power (300 kA, 100 GW) field-emission electron-beam generator. (auth)

15412 LAMPF EXPERIMENTAL-AREA BEAM CURRENT MONITORS. Tallerico, P.J. (Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545). J. Vac. Sci. Technol. 12: No. 6, 1200-1202 (Nov 1975).

This paper summarizes the design and operational performance of a wide-range current monitor system used to measure charged-particle currents in the experimental areas of the Clinton P. Anderson Meson Physics Facility (LAMPF), a proton accelerator. The major features of the system are high sensitivity, wide dynamic range, and the ability to withstand high levels of radiation. The current pulses detected are from 50 μs to 1 ms in duration at repetition rates of from 1 to 120 Hz. The pulse amplitude varies from 1 μA to 17 mA of protons or H^- ions. Both real-time and integrated outputs are available, and the minimum detectable currents are 1 μA at the video output and 50 nA at the integrated output. The basic system is comprised of toroids, preamplifiers, signal conditioners, voltage-to-frequency converters, and digital accumulators. The entire system is spread out over 1 km of beam pipe. Provision is made for calibration and for sending the outputs to remote users. The system is normally controlled by a small digital computer, which allows the system to be quite flexible in operation. The design features of the toroids and the associated electronics are discussed in detail, with emphasis on the steps taken to reduce noise and make the toroids temperature and radiation resistant. (auth)

Ion Sources and Injection and Extraction Systems

Refer also to abstract 15418.

15413 (ISN-TS-75-1) STUDY OF THE AXIAL EXTRACTION OF HEAVY IONS FROM A SOURCE OUTSIDE THE CYCLOTRON. Chan-Tung, C. S. N. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires; Grenoble-1 Univ., 38 (France)). 1975. 146p. (In French). INIS.

An inflector and a guidance system for heavy ions extracted radially from a REFLEX source with a heated cathode were studied. The beam obtained must pass through the poles and the yoke of the magnet ion source to the axial injection system of the Grenoble Cyclotron. Two beam bending magnets, one hyperbolic (Muller device) and the other pseudo cylindrical, were designed, and bench tests were made with heavy ions. The determination of the admittance of the various systems and of the emittance of the beam showed the necessity of (1) an intermediate trochoidal system before the beam bending system; and (2) the presence of an electrostatic focusing system of the poles and the yoke of the magnet. (FR)

15414 (LBL-4210) HEAVY ION SOURCE DEVELOPMENT AT THE BEVATRON. Richter, R. M.; Zajec, E. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Oct 1975. Contract W-7405-ENG-48. 7p. (CONF-751048-4). Dep. NTIS $3.50.

From international conference on heavy ion sources; Gatlinburg, Tennessee, USA (27 Oct 1975).

The Bevatron 20 MeV duoplasmatron source is currently being modified with the goal of producing 1 mA of $^{20}Neon^{3+}$. Initial tests at 420 keV show a total beam of 20 mA of which 400 mu A is $^{20}Neon^{3+}$. The quantity of beam in various charge states is determined with a pulse field magnetic spectrometer. Titanium sublimation and cryogenic pumping of the PIG source in the High Voltage Terminal and its resultant effects on the acceleration of carbon and nitrogen are discussed. (auth)

15415 NUMERICAL CALCULATIONS IN THE EXTRACTION PROCESS OF THE EINDHOVEN AVF CYCLOTRON. Schutte, F.; Hagebeuk, H. J. L.; Hagedoorn, H. L.; van Heusden, G. C. L.; Schulte, W. M. (Technische Hogeschool Eindhoven (Netherlands)). Nucl. Instrum. Methods; 127: No. 3, 317-327(15 Aug 1975).

The general equations of motions are integrated, taking into account the coupling of the horizontal and vertical motions. Extraction parameters as first-harmonic field perturbations, the imperfection resonance $\nu_r = 1$, and the difference (coupling) resonance $\nu_r = 2\nu_z$ are discussed. Special attention is given to representation of the $\nu_r = 2\nu_z$ resonance. The amplitude and azimuthal position of a first-harmonic field perturbation, in order to obtain a good extraction efficiency, are numerically determined. (NL)

15416 PMB-6 BETATRON WITH AN EXTRACTED ELECTRON BEAM. Erofeeva, G. V.; Bel'tyaev, Yu. N.; Chakhlov, V. L. (Scientific-Research Inst. of Nuclear Physics, Electronics, and Automation, Tomsk, USSR). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 695-696(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 32-33(1975).

A method has been developed for extracting the beam from the PMB-6 betatron. Results are presented of an experimental investigation of the extraction system and the parameters of the extracted electron beam. (auth)

15417 HIGH-VOLTAGE THYRISTOR GENERATOR PRODUCING MICROSECOND PULSES HAVING A STEEP TRAILING EDGE. Kalina, L. A.; Novysh, P. A.; Pavlova, T. B. Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 813-815(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 124-126(1975).

A generator is described for the injection of electrons into a betatron which produces high-voltage pulses having an amplitude of 60 kV and a length 3 μsec, which is based on thyristor switches with a shaping line and a 1:40 pulse transformer. In order to spike the trailing edge of the pulse an additional circuit is provided which has a switch similar to the main one. Special attention is devoted to overdrive of the regime in which thyristors in columns are controlled. (auth)

Ion Optics and Field Calculations

15418 (JINR-P11-9108) INVESTIGATION OF NONLINEAR RESONANCE (nu/sub x/ equals $^2/_3$) OF THIRD ORDER BY THE KRYLOV–BOGOLYUBOV METHOD IN THE SECOND APPROXIMATION. Amirkhanov, I. V.; Vasilev, V. K.; Zhidkov, E. P. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 12p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

The third order resonance (nu/sub x/ equals $^2/_3$), which was used for primary beam extraction from the JINR synchrophasotron, was studied. Shortened equations were obtained by the Krylov–Bogulyubov method in the second approximation. A complete investigation was made of these equations. (tr-auth)

15419 ACCELERATING AND SWITCHING OPTOELECTRONIC SYSTEM OF A HIGH-POWERED ACCELERATOR WITH AN INDUCTIVE STORAGE ELEMENT. Silvkov, I. N.; Dolgachev, G. I. Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 688-691 (1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 27-30(1975).

The characteristics and design of an optoelectronic system are considered, which in a high-powered pulsed electron accelerator with an inductive energy storage element, provides current switching and generation of a beam of accelerated electrons. The circuit of an accelerator with this optoelectronic system is described. (auth)

Storage Rings

15420 MEASUREMENT OF THE RADIATIVE ELECTRON POLARIZATION IN A 2.4-GeV STORAGE RING. Camerini, U.; Cline, D.; Learned, J.; Mann, A.K.; Resvanis, L.K. (Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania 19174 Phys. Rev. D. 12: No. 7, 1855-1858 (1 Oct 1975).

We have observed the existence of transverse polarization of the electron beam in the SPEAR storage ring resulting from the emission of synchrotron radiation in the magnetic field. The time constant for polarization build-up has been measured for a single circulating electron beam to be 90^{+40}_{-35} min and the corresponding equilibrium polarization to be $0.85^{+0.15}_{-0.25}$. These values are to be compared with the theoretical predictions of 124 min and 0.924, respectively. (auth)

Experimental Facilities

Refer also to abstracts 14233 and 15114.

PHYSICS (ASTROPHYSICS AND COSMOLOGY)

Cosmic Radiation

Refer also to abstracts 14936, 15720, 15729, and 15775.

15421 (CSNSM-R-75-2) CROSS SECTIONS FOR NUCLEAR REACTIONS INDUCED BY HIGH ENERGY ALPHA PARTICLES AND THE INFLUENCE OF INTERSTELLAR HELIUM IN COSMIC RAY PROPAGATION. Raisbeck, G. M.; Yiou, F. (Centre National de la Recherche Scientifique, 91- Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse). 1975. 4p. INIS.

From 14th international cosmic ray conference; Garching, near Muenchen F. R. Germany (15 Aug 1975).

Cross sections have been measured for a number of nuclides produced in the bombardment of C, O, Mg, Si, Fe and Ni targets by 2.8 and 4.6 GeV alpha particles. The results (the first for alphas of more than 230 MeV/nucleon) are interpreted in terms of the effect of about 10% interstellar He abundance on the production of secondary nuclei during propagation. (FR)

15422 (LUIP-CR-75-09) EXPERIMENTAL STUDY OF THE ISOTOPIC COMPOSITION OF COSMIC RAY NITROGEN AND OXYGEN. Jacobsson, L.; Joensson, G.; Kristiansson, K. (Lund Univ. (Sweden). Fysiska Institutionen). Aug 1975. 10p. (CONF-750805-25). Dep. NTIS (US Sales Only) $3.50.

From 14 international cosmic ray conference; Munich, F. R. Germany (15 Aug 1975).

An investigation of the isotopic composition of cosmic ray nitrogen and oxygen has been made. As a detector nuclear emulsions exposed in 1970 in a balloon flight from Fort Churchill are used. The mass determinations are made on particles stopping in the emulsion stack and are based on the relations between residual range and track width measured with a nuclear track photometer. Results extrapolated to the top of the atmosphere are $^{15}N/(^{14}N + ^{15}N) = 0.30 \pm 0.11$; $(^{17}O + ^{18}O)/(^{16}O + ^{17}O + ^{18}O) = 0.10 \pm 0.05$. (auth)

15423 (NASA-TT-F-807) COSMIC RAYS. Vernov, S. N.; Dorman, L. I. (eds.). Jan 1975. Translation of Kosmicheskiye Luchi, Sbornik Statey, No. 13, Nauka Press, Moscow, 1972. (N-75-16452). 403p. NTIS $10.50.

A translation of "Kosmicheskiye Luchi, Sbornik Statey, No. 13" is given. Abstracts are included with individual papers. (BJG)

15424 (NP-20749) CROSS SECTIONS FOR NUCLEAR REACTIONS INDUCED BY HIGH ENERGY ALPHA PARTICLES AND THE INFLUENCE OF INTERSTELLAR HELIUM IN COSMIC RAY PROPAGATION. Raisbeck, G. M.; Yiou, F. (Centre National de la Recherche Scientifique, 91-Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse). 1975. 4p. Dep. NTIS (US Sales Only) $3.50.

Cross sections have been measured for a number of nuclides produced in the bombardment of C, O, Mg, Si, Fe and Ni targets by 2.8 and 4.6 GeV alpha particles. The results (the first for alphas of more than 230 MeV/nucleon) are interpreted in terms of the effect of the ~10% interstellar He abundance on the production of secondary nuclei during propagation. (auth)

15425 A SEARCH FOR PRECURSORS TO EXTENSIVE AIR SHOWERS. Hazen, W. E. (Michigan Univ., Ann Arbor (USA). Randall Lab. of Physics); Green, B. R.; Hodson, A. L.; Kass, J. R. (Leeds Univ. (UK). Dept. of Physics). Nucl. Phys., B; 96: No. 3, 401-406(29 Sep 1975).

No evidence for precursors to cosmic ray air showers was found ("flux" $\lesssim 10^{-3}cm^{-2}sr^{-1}s^{-1}$) in a sample 2.8 times that of Clay and Crouch and a system noise level several times lower. A simple model leads to a cross section for production $\lesssim 60$ times the total proton-nucleus cross section. (NL)

15426 ACCELERATION OF COSMIC PARTICLES CAPTURED BY PLANE ELECTROMAGNETIC WAVES IN A NONHOMOGENEOUS PLASMA. Davydovskii, V. Ya.; Ukolov, A. S. Izv. Sev. Kavk. Nauchn. Tsentra Vyssh. Shk.; No. 2, 82-85(1974). (In Russian).

An examination is made of the possibility of accelerating charged particles by flat electromagnetic waves propagating in a nonhomogeneous neutral plasma with slowly increasing rate of propagation with consideration of the average force of deceleration due to Coulomb interaction between captured particles and plasma particles. It is shown that under these conditions losses associated with polarization of the medium and the possible development of beam instability are insignificant. Necessary and sufficient conditions are found for existence of a region of capture of charged particles by electromagnetic wave. Numerical estimates are presented which confirm the possibility of action of such a mechanism even in the solar corona in the case of large flares of various types. (Ref. Zh.)

15427 DETERMINATION OF THE ABSORPTION MEAN FREE PATH OF NUCLEAR-ACTIVE COSMIC RAY PARTICLES IN AIR BY MEASUREMENT OF THEIR ZENITH-ANGULAR DISTRIBUTION. Betev, B. L.; Georgiev, J. K.; Kavlakov, S. P.; Katzarski, L. M.; Kirov, I. N.; Yalamova, N. K. (Inst. of Nuclear Research and Nuclear Energy, Sofia). Bulg. J. Phys.; 2: No. 3, 199-205(1975).

The absorption mean free path of charged nuclear-active cosmic ray particles in air was determined by measurement of their zenith-angular distribution. The absorption mean free path values obtained within this method are in agreement with those determined from the altitudinal curve of the nuclear-active component. This agreement provides the basis to claim that an "anomalous" zenithal effect of the nuclear-active component does not exist. (auth)

15428 AVERAGE FLUX OF COSMIC RAY NUCLEI AT THE DISTANCE ABOUT 1 AU. Sitar, B. (Komenskeho Univ., Bratislava). Acta Fac. Rerum Nat. Univ. Comenianae, Phys.; 15: 233-248(1975). (In Czech)

The average flux of solar protons during the 19. and the first part of the 20. solar cycle and the average flux of nuclei in the solar and galactic cosmic rays are counted. The upper limit of cosmic-ray nuclei accretion on the Earth is evaluated. (auth)

15429 INTRODUCTION TO COSMIC RADIATION. Allkofer, O. C. Buchreihe der Atomkernenergie. Muenchen, F. R. Germany; Thiemig (1975). 221p.

With figs., tabs., and refs.

This book gives an up-to-date survey of the whole field of cosmic radiation. It has more the character of a textbook so that it can be used by students as an introduction to this topic and as a small reference book for graduate students working in this field. The main chapters of this book are: Historical survey, basic data of astrophysics, galactic cosmic radiation, the origin of cosmic radiation, interactions with matter, basic features of the elementary particles, cascade showers, transformation in the atmosphere, leptons at sea level and underground, extensive air showers, geomagnetic effects, solar cosmic radiation, time variations of cosmic radiation, biophysical significance of cosmic radiation, applications of cosmic radiation. (DE)

15430 COSMIC-RAY COMPOSITION MEASUREMENTS WITH HIGH-ENERGY IONIZATION SPECTROMETERS. Arens, J.F.; Ormes, J.F. (NASA/Goddard Space Flight Center, Greenbelt, Maryland 20771). Phys. Rev. D 12: No. 7, 1920-1935 (1 Oct 1975).

Element abundances of cosmic rays for elements Li through Si with energy above 0.8 GeV/amu were measured on a balloon-borne instrument containing a total absorption ionization spectrometer. Statistical techniques were used to analyze the five measurements of each particle to determine its charge and energy. The technique allows a determination of systematic errors to be made. Corrections for Landau fluctuations, spark-chamber inefficiency, and background particles were included. Comparison with other published results is made. There are differences in the shapes of the differential spectra determined from measurements using different techniques, and our intensities still lie somewhat below those of other workers. (auth)

Stars

Refer also to abstracts 15454-15457, 15786, 15932, 15934, and 16227.

15431 (CSNSM-TS-75-3) EXPLOSIVE NUCLEOSYNTHESIS IN ZONES RICH IN HYDROGEN AND HELIUM. Toussaint, J. (Centre National de la Recherche Scientifique, 91- Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse; Paris-11 Univ., 91- Orsay (France)). 1975. 115p. (In French). INIS.

Explosive nucleosynthesis was studied for elements with masses lower than that of ^{35}Cl at temperatures between 10^8 to 10^9 K. It is shown that in some astrophysical objects (Novae, Supernovae or super-massive-stars) an explosive nucleosynthesis of isotopes such as ^3He, ^7Li, ^{25}Mg or ^{29}Si is possible. The existence of those elements in the interstellar medium would make possible, ultimately, the formation of heavier elements (iron peak and above). (FR)

15432 (ESRO-SP-105, pp 209-220) STAR FORMATION AND CONTRACTION/FRAGMENTATION PROBLEMS. Whitworth, A. P. Nov 1974.

From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).

Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.

In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4-7 June 1974, Frascati, Italy. (European Space Research Organization, 92- Neuilly-sur-Seine (France)).

A general framework for theories of star formation is proposed. The processes that determine the mass-spectrum and spatial configuration of stars formed in association are discussed, the processes being evaluated in terms of the energy imbalance which drives them and the competitivity of their time-scales. A trend in the contraction/fragmentation sequence (CFS) may be important in terminating fragmentation, and hence in determining the masses of protostellar clouds this trend derives from the interaction between magnetic and centrifugal forces. The condensation time-scale problem is can subclouds condense out of a contracting parent-cloud sufficiently early and fast that they avoid inelastic collisions, and thus remain dispersed by the subsequent approximate equipartition of their mutal gravitational and randomized bulk kinetic energies. It is shown that when a prospective subcloud becomes unstable against contraction, it already exists as a well-defined, gravitationally bound nodule (i.e., there is already substantial density contrast between the nodule and the background density defined by the parent-cloud). Consequently, condensation may proceed efficiently until centrifugal forces become important. The implications of this result for star formation and stellar dynamics are considered. (FR)

15433 SPECTRUM OF THE SUPERNOVA DISCOVERED IN 1974 IN NGC 4414. Andrillat, Y. (Observatoire de Haute Provence, 04-Saint-Michel-l'Observatoire (France)). C. R. Hebd. Seances Acad. Sci., Ser. A, B; 280: No. 19, 605-608(21 May 1975). (In French)

A spectrum of the Supernova SN 1974-NGC 4414 between 3100-5000 A with a dispersion of 67 $A \cdot mm^{-1}$ near maximum light has been obtained. This spectrum shows the characteristic features of all type I supernovae: wide absorption bands, large expansion velocity and a clear decrease of the ultraviolet radiation ($\lambda <$ 3600 A). (FR)

15434 OBSERVATIONS OF PULSARS AT HIGH FREQUENCIES. Sieber, W.; Reinecke, R.; Wielebinski, R. (Max-Planck-Institut fuer Radioastronomie, Bonn (F. R. Germany)). Astron. Astrophys.; 38: No. 2, 169-182(Jan 1975).

5 figs.; 5 tabs.; 22 refs.

Using the MPIfR 100m radio-telescope, observations of mean pulse profiles have been made of a large sample of pulsars at 2.7, 4.9, and 10.7 GHz. The measurements were repeated many times during numerous observing sessions so that the data presented take account of the short-term and medium-term fluctuations of pulsar energies. The observed pulsars are compared with similar observations at lower frequencies showing that in nearly all cases the mean pulse shape changes with frequency. The changes include both variations of the 3dB-width of pulse profiles and variations of component distances. It is shown that in the majority of cases, pulse widths decrease with increasing frequency, whereas the component distances may either increase or decrease. The component separation may furthermore be characterized by a critical frequency which is correlated with the cut-off frequency in the spectra of the corresponding pulsars. (DE)

15435 AXISYMMETRIC α^2-DYNAMOS IN THE HAYASHI-PHASE. Schuessler, M. (Geottingen Univ. (F. R. Germany). Sternwarte). Astron. Astrophys.; 38: No. 2, 263-270(Jan 1975).

6 figs.; 27 refs.

The evolution of axisymmetric magnetic fields during the Hayashi-phase is investigated on the basis of the α-effect dynamo mechanism. In particular, the influence of the transition from the fully convective to the fully radiative main sequence state (for A stars) is considered for rigid rotation. The fields are calculated by solving the induction equation as an initial value problem. The numerical results show that a dynamo-built magnetic field can "survive" the transition while conserving the main part of its total flux. The topology of the field can change significantly during the evolution. For a certain phase of the transition to the main sequence there are oscillating fields, possibly giving an explanation for magnetic stars with long periods. (DE)

15436 EARLY NEUTRON-STAR MATTER. Hilf, E. R. (Technische Univ. Darmstadt (F. R. Germany). Inst. fuer Kernphysik). pp 57-79 of Mesonic Effects in Nuclear Structure. Bleuler, K. (ed.). Mannheim, F. R. Germany; Bibliographisches Institut (1975).

From symposium on mesonic effects in nuclear structure in remembrance of K. Erkelenz; Bonn, F. R. Germany (29 Jan 1974). 9 figs.; 17 refs.

After a short discussion of the properties of matter in its energy ground state at high densities, hot nuclei and their nuclear transfer reactions in the early stage of a neutron star, the disintegration of Fe nuclei in the hydrodynamical supernova model and hot nucleonic systems are considered. (DE)

15437 DRIFTING SUBPULSES AND PULSAR SLOWDOWN RATES. Ritchings, R. T.; Lyne, A. G. (Nuffield Radio Astronomy Labs., Jodrell Bank, Eng.). Nature (London); 257: No. 5524, 293-294(25 Sep 1975).

It is stated that although many models have been proposed to explain the observed radiation from pulsars none has yet explained satisfactorily all the features of pulsar emission. Evidence is here presented for a close relationship between the direction of drifting of sub-pulses from a pulsar and its position in a P-$\dot{P}$ diagram — the plot of the derivative of a pulsar's period, $\dot{P}$, against the period, P. Single pulse observations of several pulsars were made using the Mark 1A radiotelescope at Jodrell Bank, and sequences of pulses showing sub-pulse drift were recorded for PSR1112 + 50, PSR1642 - 03, PSR1944 + 17, and PSR2319 + 60. These are discussed. It seems that some form of dragging on the particle bunches responsible for the sub-pulse radiation may be associated with pulsar braking. The exact nature of the association between the braking and dragging is not clear, but it may be concerned with the magnetic dipole moment of the pulsar, which is thought to be related to the rate of slowing down of the pulsar; it has been suggested that the evolution of pulsars involves a decrease in the effective dipole moment. This would happen if the pulsar magnetic field decayed or realigned, or if its configuration in the magnetosphere became more complicated as the pulsar grew older. It seems that the sub-pulses drift later while the magnetic dipole moment is strong, but changes their direction of drift when it becomes weaker in the later stages of the pulsar lifetime. The relationship suggested is based on observation of only a limited number of pulsars, and further observations are required to satisfactorily test this apparent relationship. Such a relationship might lead to a better understanding of pulsar physics. (UK)

15438 ELECTRICAL CONDUCTIVITY AND EMISSIVITY OF THE PULSAR SURFACE. Itoh, N. (Cambridge Univ., Eng.). Mon. Not. R. Astron. Soc.; 173: No. 1, 1P-3P (Oct 1975).

The electrical conductivity of the pulsar surface in the presence of a strong magnetic field is estimated. It is found that the conductivity perpendicular to the magnetic field is $\sim 10^4$ times smaller than that parallel to the magnetic field. The emissivity of the surface is found to be strongly affected by the magnetic field, and a strong polarization in the thermal radiation is predicted. (auth)

15439 RAPID BLUE VARIABLES. XVII. V436 Centauri. Warner, B. (Cape Town Univ.). Mon. Not. R. Astron. Soc.; 173: No. 1, 37P-40P(Oct 1975).

High speed photometric observations of V436 Cen during a supermaximum in 1975 June show it to have recurrent humps with a period of 92 min, indicating an orbital period of near this value. Rapid oscillations in brightness, with periods near 20 s, were present over a total of 3 days. (auth)

15440 ANGULAR DIAMETER OF PSI VIRGINIS. Walker, A. R. (Cape Town Univ.). Mon. Not. R. Astron. Soc.; 173: No. 1, 29P-32P(Oct 1975).

The angular diameter of the M3 III star φ Virginis was measured on 1975 May 21 by the lunar occultation method. A value of 6.1 ms arc is found, assuming a fully limb-darkened disc, with an error of 5 per cent. The star is a close double, with vector separation 40 ms arc and a red magnitude difference of 4.4. (auth)

15441 HARO 13A: A LUMINOUS, HEAVILY OBSCURED STAR IN ORION. Allen, D. A. (Royal Greenwich Observatory, Hailsham, Eng.); Strom, K. M.; Grasdalen, G. L.; Strom, S. E.; Merrill, K. M. Mon. Not. R. Astron. Soc.; 173: No. 1, 47P-50P (Oct 1975).

Haro 13a may be a luminous pre-main-sequence star of the Orion population obscured by over 20 mag of visual extinction. (auth)

15442 OBSERVATIONS OF EIGHT GLOBULAR CLUSTERS AT 2.3 AND 4.7 μm. Hansen, O. L.; Hesser, J. E. (Cerro Tololo Inter-American Observatory, La Serena, Chile). Nature (London); 257: No. 5527, 568-569(16 Oct 1975).

Observations were made in June 1975 using the 1.5 m Cerro Tololo telescope and an InSb detector on the dual-beamed photometer operating at 10 Hz. The clusters observed are shown tabulated, including their approximate apparent magnitude. Results are discussed. (UK)

15443 SOFT X RAYS FROM SIRIUS. Mewe, R.; Heise, J.; Gronenschild, E. H. B. M.; Brinkman, A. C.; Schrijver, J.; Den Boggende, A. J. F. (Astronomical Inst., Utrecht). Nature (London); 256: No. 5520, 711-712(28 Aug 1975).

Some observations of Sirius made with the soft x-ray detector on the Astronomical Netherlands Satellite (ANS) in April 1975 are described. This detector consists of a parabolic collecting mirror having at its focus a proportional counter with a 3.6 μm polypropylene window, and responds to x-rays in the energy range 0.284 to ~0.2 keV. Means were employed to allow for background and determination of any UV contamination by light from the star. The x-ray luminosity in the energy band 0.284 to 0.2 keV was found to be $(9.1 \pm 1.6) \times 10^{27}$ erg/sec. The observations could be explained by invoking x-ray emission from a hot corona around one of the two components of the Sirius binary system. The accretion mechanism appears to fail to explain the observed x-radiation. (UK)

15444 PROBABILITY DISTRIBUTION OF PARTICLES CREATED BY A BLACK HOLE. Parker, L. (Department of Physics, University of Wisconsin–Milwaukee, Milwaukee, Wisconsin 53201). Phys. Rev. D 12: No. 6, 1519-1525 (15 Sept 1975).

It has been demonstrated by Hawking that a spherical black hole formed by collapse will create particles, and that the average number of outgoing particles created in each mode satisfies a thermal distribution law. Recently, Wald has shown that the probability distribution of the number of outgoing particles in each mode, and not only the average number, obeys the thermal distribution law. In this paper, we give a simpler and more direct derivation of the blackbody probability distribution of the emitted particles. (auth)

15445 GAUGE-INVARIANT PERTURBATIONS OF REISSNER-NORDSTRÖM BLACK HOLES. Moncrief, V. (Department of Physics, University of Utah, Salt Lake City, Utah 84112). Phys. Rev. D 12: No. 6, 1526-1537 (15 Sept 1975).

We present the details of previously published results on the stability of the Reissner-Nordström family of black holes and discuss, in some detail, the reduction techniques which were used to simplify the perturbation problem. We develop the Hamiltonian formalism for the perturbations of an arbitrary static solution of the Einstein-Maxwell equations (with vanishing magnetic field) and show explicitly that the perturbed constraints are the generators of the coordinate and electromagnetic gauge transformations of the canonical perturbation variables. We show that the perturbed constraints have vanishing Poisson brackets with one another and use this result as the basis for our reduction technique. The canonical transformations which accomplish the reduction and the perturbation Hamiltonian are given explicitly for the Reissner-Nordström problem. We include a stability result for the (odd- and even-parity) $L=1$ perturbations which were not previously considered. (auth)

15446 ELECTROMAGNETIC FIELD OF A CURRENT LOOP AROUND A KERR BLACK HOLE. Chitre, D.M. (Department of Physics, University of California, Santa Barbara, California 93106); Vishveshwara, C.V. Phys. Rev. D 12: No. 6, 1538-1543 (15 Sept 1975).

The electromagnetic field due to a current loop placed around a Kerr black hole is investigated within the framework of perturbation theory. The asymptotic behavior of the field at large distances from the black hole is studied. The process of charge accretion into the black hole due to the electric field generated by the loop is discussed. (auth)

Quasi-Stellar, Radio, and X-Ray Sources

Refer also to abstracts 15442, 15443, 15487, 15496, 15501, 15503, 15504, and 15532.

15447 (AD/A-005955) SOME PROBLEMS IN MODERN RADIOASTRONOMY. Braude, S. Ya. Translated from Visn. Akad. Nauk Ukr. RST; No. 3, 47-55(1969). 17p. (FSTC-HT-23-2587-73). NTIS $3.25.

The way space objects emit radiation and scatter radiowaves is briefly reviewed. (GRA)

15448 (ESRO-SP-105, pp 111-115) HIGH-RESOLUTION RADIO OBSERVATIONS OF THE SOURCES NEAR K3-50. Harris, S. Nov 1974.

From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).

Published by ESRO Scientific and Technical Information Branch, c/o ESTEC, Noordwijk, Netherlands.

In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4-7 June 1974, Frascati, Italy. (European Space Research Organization, 92- Neuilly-sur-Seine (France)).

The group of radio sources near the optical objects K3-50 has been observed at 5 GHz with the Cambridge 5 km telescope. Two of the sources show high-density compact structure, the one coincident with K3-50 itself having an unusually high brightness temperature. It is particularly interesting to compare the radio infrared and optical observations of these sources. (FR)

15449 (ESRO-SP-105, pp 121-123) RADIO RECOMBINATION LINES FROM CARBON AND HEAVIER ELEMENTS FROM THE DIRECTION OF NGC 2024. Hart, L.; Pedlar, A. Nov 1974.

From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).

Published by ESRO Scientific and Technical Information Branch, c/o ESTEC, Noordwijk, Netherlands.

In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4-7 June 1974, Frascati, Italy. (European Space Research Organization, 92- Neuilly-sur-Seine (France)).

Chaisson et al. [1972] have detected recombination line emission which could correspond to an element or elements with mass greater than carbon in a 157α and 158α (λ 18 cm) radio recombination lines. In this paper similar, but more sensitive, observations of the 166α line which confirm the above result are reported. (FR)

15450 (ESRO-SP-105, pp 127-134) OH AND THE EARLIEST EVOLUTION OF H II REGIONS. Habing, H. J. Nov 1974.

From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).

Published by ESRO Scientific and Technical Information Branch, c/o ESTEC, Noordwijk, Netherlands.

In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4-7 June 1974, Frascati, Italy. (European Space Research Organization, 92- Neuilly-sur-Seine (France)).

Continuum radiation near thirteen Type I OH masers whose absolute positions were determined previously to within a few arc seconds are mapped. The properties of the small continuum sources (radio continuum spectra and infrared properties) are studied. (FR)

15451 WHY THE NUMBER OF GALACTIC X-RAY STARS IS SO SMALL. Illarionov, A. F.; Sunyaev, R. A. (AN SSSR, Moscow. Space Research Inst.). Astron. Astrophys.; 39: No. 2, 185-195(Mar 1975).

3 figs.; 37 refs.

The number of galactic x-ray sources is by 4 to 7 orders of magnitude less than the expected number of neutron stars and black holes in binary systems. It is shown in the paper that the main condition for the appearance of x-ray source in a binary system including relativistic star is that the size of the normal component must be close to the size of its critical Roche lobe. (DE)

15452 DRIFTING SUBPULSE BEHAVIOR OF PSR'S 0,943 + 10 AND 2,303 + 30. Sieber, W. (Max-Planck-Institut fuer Radioastronomie, Bonn (F. R. Germany)); Oster, L. (Bonn Univ. (F. R. Germany). Inst. fuer Astrophysik und Extraterrestrische Forschung). Astron. Astrophys.; 38: No. 2, 325-327(Jan 1975).

5 figs.; 1 tab.; 8 refs.

The parameters P_2 and P_3 are derived for the drifting-subpulse patterns of PSR 0,943 + 10 and 2,303 + 30, the ambiguity in drift direction is discussed on a theoretical basis, and a decision suggested in the case of PSR 0,943 + 10. For PSR 2,303 + 30 two systems are found and compared with previous results. (DE)

15453 GEOMAGNETIC EFFECT ASSOCIATED WITH X-RAY FLARE FROM SCO X-1. Sastri, J. H.; Murthy, B. S. (Indian Inst. of Astrophysics, Kodaikanal). Nature (London); 257: No. 5521, 35-36(4 Sep 1975).

It is stated that possible effects of x-radiation from celestial sources on the lower ionosphere is a matter of controversy. In this connection galactic x-ray ionization has been shown to affect night-time geomagnetic field components. The possibility was examined that an x-ray flare from Sco X-1, detected in the course of a balloon flight on October 15th 1967 at Mildura (34° 12′ S; 142° 6′ E), had a daytime geomagnetic effect. A perturbation in the form of an increase in the horizontal component of the magnetic field at the equatorial station at Kodaikanal (10° 14′N; 77° 28′ E) was observed. At this time Sco X-1 flared up, reaching a maximum in less than 10 min. and then decreasing during the next 20 min. The perturbation is considered to be a genuine effect of the x-ray flare. (auth)

15454 COPERNICUS OBSERVATIONS OF CIRCINUS X-1. Davison, P. J. N.; Tuohy, I. R. (Mullard Space Science Lab., Dorking, Eng.). Mon. Not. R. Astron. Soc.; 173: No. 1, 33P-35P(Oct 1975).

Copernicus X-ray observations are presented of Circinus X-1 made during August 1973 and April 1974. The results confirm that the reported 12.3-day periodicity is spurious, and in addition, the data show a clear correlation between the low energy X-ray intensity and spectral slope. (auth)

15455 EFFECTS OF A DEPARTURE FROM CO-ROTATION IN X-RAY BINARIES. Wickramasinghe, D. T. (Cambridge Univ., Eng.). Mon. Not. R. Astron. Soc.; 173: No. 1, 21-31 (Oct 1975).

The effects of a departure from co-rotation on the light curves of X-ray binaries are computed. The results are used to discuss the observations of 3U 0900-40. (auth)

15456 DIFFERENTIAL UVBY PHOTOMETRY OF CYGNUS X-1. Lanning, H. H. (San Diego State Univ., CA). Mon. Not. R. Astron. Soc.; 173: No. 1, 15-19P(Oct 1975).

Strömgren uvby differential photometry of the X-ray source Cygnus X-1 is presented. Variations in the light curve as large as $0^m.05$ at primary and $0^m.03$ at secondary are noted. (auth)

15457 OBSERVATION OF A LINE FEATURE IN THE X-RAY SPECTRUM OF CYGNUS X-3. Sanford, P.; Mason, K. O.; Ives, J. (Mullard Space Science Lab., Dorking, Eng.). Mon. Not. R. Astron. Soc.; 173: No. 1, 9P-14P(Oct 1975).

A narrow emission feature at ≈6.5 keV has been detected in the spectrum of Cygnus X-3, using instrumentation on the Ariel-5 satellite. The average strength of the feature is 0.027 ± 0.004 photon cm^{-2} s^{-1}. The strength varies with the phase of the 4.8-hr binary cycle, but is the same as that seen by Serlemitsos et al. when the overall source intensity was much lower. (auth)

15458 ABELL 478 AND X-RAY SOURCE 3U0405 + 10. Elvis, M.; Cooke, B. A.; Pounds, K. A.; Turner, M. J. L. (Leicester Univ., Eng.). Nature (London); 257: No. 5521, 33-34(4 Sep 1975).

It is stated that several recent sightings of the faint x-ray source 3U0405 + 10, using the Ariel V sky survey instrument, have allowed a more accurate position to be obtained for the source, with the error box now containing Abell 478, which is the most distant x-ray source yet detected, with a 2 to 20 keV x-ray luminosity of $(5.4 \pm 1.1) \times 10^{45}$ ergs/sec. The instrument employed detected x-ray emission from 3U0405 + 10, in October 1974, with both high (2.4 to 19.8 keV) and low (1.2 to 5.8 keV) energy detector systems. The improved location is regarded as confirming the association of A478 with the x-ray source 3U0405 + 10. The distance to the source is estimated as 900 Mpc. (UK)

15459 OBSERVATIONS OF X RAYS FROM NEAR NGC6440. Markert, T. H.; Backman, D. E.; Canizares, C. R.; Clark, G. W.; Levine, A. M. (Massachusetts Inst. of Tech., Cambridge). Nature (London); 257: No. 5521, 32-33(4 Sep 1975).

Data obtained with the MIT instrument carried by the satellite OSO-7, on a number of occasions between October 1971 and January 1973, were analysed and several previously unreported x-ray sources were discovered. In these observations the region of the sky within about 10° of the galactic center was scanned. The most intense of the new sources was found at $\alpha = 17$ h 46 min, and is termed MX1746-20. The instrument employed consisted of two banks of five proportional counters sensitive from 1 to 60 keV. MX1746-20 was found to be a highly variable x-ray source on time scales of months, variations by a factor of at least 20 being observed. The nature of the spectrum could not be determined unambiguously owing to the small number of data points available; although attempts were made to fit a bremsstrahlung spectrum and a power law spectrum. A search of star catalogues revealed only one likely candidate in the MX1746-20 error circle, namely the globular cluster NGC6440. Assuming a distance of 10 kpc to MX1746-20 a peak 1 to 10 keV x-ray luminosity of 3.4×10^{37} ergs/sec. is derived. It is thought that many more such systems may remain to be found. (UK)

15460 ANOMALOUS TEMPORAL BEHAVIOUR OF HER X-1. Cooke, B. A.; Page, C. G. (Leicester Univ., Eng.). Nature (London); 256: No. 5520, 712-713(28 Aug 1975).

During January 1975 the Leicester Sky Survey experiment aboard the satellite Ariel V observed anomalous x-ray emission from Her X-1 during its off state. Although Her X-1 has been extensively studied, observations have been concentrated on the on state, and the probability of detecting emission during the off state was low. The emission here described showed considerable variation in intensity. Results are shown tabulated, and mechanisms are suggested. (UK)

15461 WHISKERS AND COSMIC MILLIMETRE-WAVE SOURCES. Edmunds, M. G.; Wickramasinghe, N. C. (University Coll. of South Wales and Monmouthshire, Cardiff). Nature (London); 256: No. 5520, 713-714(28 Aug 1975).

Many extragalactic objects—for example N-type galaxies, Seyferts and QSOs—are strong emitters of infra red and mm wave radiation. For Seyfert galaxies the most likely model for the 2 to 20 μm radiation involves a central source of primary radiation surrounded by a shell of solid particles that absorb the primary radiation and re-emit it in the infra red. The formation of dust could occur in expansion phases following explosions of massive stars, and the primary radiation may take the form of UV photons, soft x-rays, or low energy cosmic ray nucleons. The dust particles invoked for these models have hitherto been assumed to be similar to solid particles thought to exist in our own galaxy, and nearly spherical grains of radii 10^{-6} to 10^{-5} cm. could account for the observed 2 to 20 μm fluxes with reasonable mass requirements. A serious difficulty arises, however, with regard to total grain mass if the same grains are to explain the observed mm and sub-mm wave radiation. The mass estimates are considerably reduced if long whisker grains of length 10^{-2} to 10^{-1} cm are present in the emitting dust shell. In the case of graphite it is calculated that in the form of whisker grains the mass requirements can be down by a factor of about 1.5×10^3. This gives grain mass estimates of 10^3 $M_\odot$ for explaining the mm fluxes from Seyferts and 10^6 to 10^8 $M_\odot$ for QSOs, which are within the reasonable range. The same applies to ice whiskers and formaldehyde polymer whiskers coated with impure ice. (UK)

15462 OBSERVATIONS OF 3C33, 61.1, 379.1, AND 390.3 AT 5GHz WITH THE 15-KM RADIO TELESCOPE. Hargreave, P. J.; McEllin, M. (Cambridge Univ., Eng.). Mon. Not. R. Astron. Soc.; 173: No. 1, 37-63(Oct 1975).

The Cambridge 5-km radio telescope has been used to map the sources 3C 33, 61.1, 379.1 and 390.3 in both total intensity and linear polarization. The maps, which have a resolution of 2.0″ arc in right ascension and 2.0″ cosec δ in declination, reveal that the components of these sources contain features of high surface brightness, some of which show striking alignment with the associated optical objects. These features are in many cases highly polarized (up to 40 percent) indicating that the scale of the magnetic field irregularities within them cannot be much smaller than the resolution of the telescope. The results of the observations are discussed in the light of the various theoretical models proposed to explain the existence of double extragalactic radio sources. It is concluded that the most tenable models are those in which energy is continuously transported to the components from the nucleus of the galaxy in the form of a beam of relativistic particles or low frequency waves. (auth)

15463 NARROW EMISSION LINE NEAR 1720 MHz IN THE DIRECTION OF Sgr A. Whiteoak, J. B.; Gardner, F. F. (Commonwealth Scientific and Industrial Research Organization, Epping, Australia). Mon. Not. R. Astron. Soc.; 173: No. 1, 25P-28P(Oct 1975).

A narrow emission feature (of half-width 4.5 km s^{-1} in velocity) has been detected in the 1720 MHz OH-line spectrum of Sgr A at a frequency that would correspond to an OH velocity of + 132 km s^{-1} (lsr). However, the identification as an OH transition is questioned because there are no features of similar velocity in the line profiles of either the other OH ground-state transitions or transitions for other molecules. (auth)

15464 POLARIMETRIC MEASUREMENTS AT Hα AND Hβ OF X PER. Clarke, D.; McLean, I. S. (Glasgow Univ.). Mon. Not. R. Astron. Soc.; 173: No. 1, 21P-24P(Oct 1975).

Polarimetric measurements have been made of the star X Per at Hα and Hβ. No reduction of polarization was observed at these emission lines on a scale which has been seen in other early-type emission line stars. There is conflicting evidence on the origin of the polarization associated with this star, whether it is intrinsic to the star or has an interstellar origin. (auth)

15465 MEASUREMENTS OF THE LINEAR AND CIRCULAR POLARIZATION OF SOME COMPACT RADIO SOURCES AT 5 GHz. Ryle, M.; Odell, D. M.; Waggett, P. C. (Cambridge Univ., Eng.). Mon. Not. R. Astron. Soc.; 173: No. 1, 9-20(Oct 1975).

Observations have been made at λ 6 cm with the 5-km telescope to determine the linear polarization of 60 compact sources and the circular polarization of five of them. The method of observation allows limits to be set on the instrumental polarization of about 0.03 percent for both linear and circular polarization; in practice the limitations are nearly always determined by the finite signal-to-noise ratio. An attempt to find physically useful relationships between the magnitude of the linear polarization and other properties of the sources has proved no more successful than previous analyses using a different source sample. No circularly-polarized emission was detected in any of the five sources studied, and the new upper limits avoid the theoretical difficulties associated with the earlier reported values. (auth)

15466 DISCOVERY OF POWERFUL TRANSIENT X-RAY SOURCE A0620-00 WITH ARIEL V SKY SURVEY EXPERIMENT. Elvis, M.; Page, C. G.; Pounds, K. A.; Ricketts, M. J.; Turner, M. J. L. (Leicester Univ., Eng.). Nature (London); 257: No. 5528, 656-657(23 Oct 1975).

On August 3, 1975 a faint new x-ray source was discovered

near the boundary of the Monoceros and Orion constellations, and 6° from the galactic plane, during routine monitoring of the Milky Way using the Ariel V Sky Survey Experiment equipment. During the following week the source, designated A0620-00, increased rapidly in intensity and became the brightest in the sky, at 2 to 18 keV. The x-ray light curve from continued observation up to August 16 is shown, in comparison with the Crab Nebula and Sco X-1. It is thought that the intensity remained very high at least until August 27. Some theoretical considerations are discussed. (UK)

15467 X-RAY SPECTRUM OF A0620-00. Ricketts, M. J.; Pounds, K. A.; Turner, M. J. L. (Leicester Univ., Eng.). Nature (London); 257: No. 5528, 657-658(23 Oct 1975).

A remarkable change in the x-ray spectrum of the transient source A0620-00 was observed in the Ariel V Sky Survey Experiment during the rise of the source to maximum brightness. When the source was first detected the spectrum was hard and remained so as the intensity rose towards a peak. During the subsequent rise to maximum intensity, due to strong enhancement of x-rays below 10 keV, a marked softening of the spectrum was observed. This spectral evolution is stated to provide an interesting insight into the nature of the source. Considering a binary model with unstable mass transfer the hard initial emission may be regarded as arising from the hottest regions of an accretion disk lying close to the compact star; then as more mass is accreted the disk grows rapidly, causing a corresponding increase in the x-ray intensity, and since the outer parts of the enlarged disk will be cooler the x-ray spectrum will soften. Also the reduction in the flux above 10 keV as the source increases towards maximum brightness may well be due to the hot inner regions of the disk being partially obscured by the mass of outerlying gas. It is thought that the detailed analysis of the light curve given and the spectral evolution obtained may yield important information on accretion and disk formation in close binary systems. (UK)

15468 X-RAY OUTBURST FROM THE DIRECTION OF THE GALACTIC CENTER. Eyles, C. J. (Univ. of Birmingham, Eng.); Skinner, G. K.; Willmore, A. P.; Rosenberg, F. D. (Univ. of Birmingham, Eng.). Nature (London); 257: No. 5524, 291-293 (25 Sep 1975).

Details are given of a transient point x-ray source that was observed at the region of the galactic center by the Ariel V rotation modulation collimator. Its rise to a peak and subsequent decline by a factor of two over 12 days were monitored. Its position was found to be $\alpha = 17h\ 42$ min. 26.0 ± 4.8 sec., $\delta = -28°\ 59.8 \pm 1.2'$. The intensity variation of this new source is shown graphically. The source is termed A1742-28. At the peak the observed flux was about 4×10^{-8} erg/sec/cm^2 in the energy range 3 to 10 keV. The source appears to lie very close to the direction of the radio source Sgr A and the associated infrared emission region. It is concluded that the source is directly associated with one of the radio or infrared sources that lie within Sgr A. The fact that the rise and turnover of the light curve occurred on the time scale of the order of 2 days probably implies an emission region less than 0.002 pc. in diameter. (UK)

15469 CANDIDATE FOR LMC X-5. Byrne, P. B. (Dunsink Observatory, Dublin). Nature (London); 257: No. 5522, 110(11 Sep 1975).

Reference is made to a new x-ray source, termed LMC X-5, recently reported in the Large Magellanic Cloud, and attention is drawn to the close proximity of the radio sources MC32 and 33 to its x-ray position. MC32/33 is one of six double radio sources, having one thermal and one non-thermal component, found in the LMC. MC32/33 is optically identified with the H II region N44, which has a ring like structure, strengthening its supernova interpretation. LMC X-5 appears to be a highly variable x-ray source, as evidenced by the failure to detect it in Uhuru data. The implication is that the x-rays are emitted by a compact object, such as a neutron star, which might be expected in association with a supernova remnant. The system MC32/33 is suggested as a suitable candidate for LMC X-5. (UK)

Solar Phenomena

Refer also to abstracts 15426 and 15523.

15470 (COM-74-50190-364-1/SL) SOLAR-GEOPHYSICAL DATA NUMBER 364, DECEMBER 1974. Part I (Prompt Reports). Data for November 1974, October 1974. Leighton, H. I. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. (USA)). Dec 1974. 123p. (SGD-364(Pt. 1)). National Climatic Center, Asheville, NC $1.40.

See also COM-74-50190-364-2.

Prompt reports are given on data for November 1974 and October 1974. These deal with alert periods, daily solar indices, solar flares, solar radio waves, spacecraft observations, solar proton monitoring, solar x-ray radiation, inferred IP magnetic field polarities, daily solar activity centers, sudden ionospheric disturbances, cosmic rays, geomagnetic indices and radio propagation indices. This issue also includes an index for 1973 and 1974. (GRA)

15471 (COM-74-50190-364-2/SL) SOLAR-GEOPHYSICAL DATA NUMBER 364, DECEMBER 1974. Part II (Comprehensive Reports). Data for May 1974-June 1974 and Miscellanea. Leighton, H. I. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. (USA)). Dec 1974. 65p. (SGD-364(Pt. 2)). National Climatic Center, Asheville, NC $1.40.

See also COM-74-50190-364-1.

This issue provides comprehensive data for June 1974 and April 1974 on solar flares, solar radio waves, abbreviated calendar record, and regional flare index. It also includes miscellaneous data on cosmic rays and solar x-ray radiation. (GRA)

15472 (FRNC-TH-523) CORONAL STRUCTURES AND PARTICLE ACCELERATION STUDIES FROM RADIOELECTRIC AND OPTICAL OBSERVATIONS. Axisa, F. (Paris-7 Univ., 75 (France)). 1974. vp. (In French). INIS.

The problem of acceleration outside of and during eruptions is studied from the association of type III radioelectric jumps with the chromosphere activity observed in absorption and emission of the Hα line. In addition the mean corona structure is investigated from observation of the slowly variable metric wave component in connection with coronal filaments and jets, and by type III emission in relation to the eruptive sites of complex active regions. Most of the experimental material comes from observations made with Nancay East-West radioheliograph, which works on 169 MHz and optical observations carried out at the Meudon Observatory on the chromosphere and on photosphere magnetic fields. (FR)

15473 RADIO ASTRONOMICAL OBSERVATIONS OF WAVE MOTIONS IN THE SOLAR ATMOSPHERE WITH PERIODS SHORTER THAN ONE MINUTE. Apushkinskii, G. P.; Baryshev, Yu. V.; Tsyganov, A. N. (Leningrad State Univ.). Izv. Vyssh. Uchebn. Zaved., Radiofiz.; 18: No. 6, 812-815(1975). (In Russian).

A statistical division of the solar radio emission flux fluctuations observed at 8 mm of solar and atmospheric origin is made. The use of a sensitivity radiometer allows short-lived fluctuations, with the period of about 11 sec to be discovered in the spectrum of the quiet Sun. (auth)

Galaxies

Refer also to abstracts 15450, 15515, 15608, 15693, and 15800.

15474 (ESRO-SP-105, pp 1-11) ORION NEBULA: A PHOTOGRAPHIC STUDY OF SPATIAL STRUCTURE. Gull, T. R. Nov 1974.

From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).

Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.

In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4-7 June 1974, Frascati, Italy. (European Space Research Organization, 92- Neuilly-sur-Seine (France)).

The structure of the neutral and ionized regions of the Orion Nebula is described as recorded on direct photographic plates through selected interference filters. Seven of the plates, which were exposed at the prime focus station of the Mayall telescope, are reproduced here. Differences in structure are noted in the continuum, Hα + [N II], [S II], and Hβ exposures. The geometry and variations of the structure plus polarization information leads to the conclusion that much of the outer region of the Orion Nebula is reflection nebula. (FR)

15475 (ESRO-SP-105, pp 13-17) OPTICAL OBSERVATIONS OF A FEW SMALL H II REGIONS DETECTED AT INFRARED WAVELENGTHS. Lortet-Zuckermann, M. -C. Nov 1974.

From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).

Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.

In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4-7 June 1974, Frascati, Italy. (European Space Research Organization, 92- Neuilly-sur-Seine (France)).

Several observational results (Bohuski, Deharveng-Baudel, Elliott and Meaburn) on the density and brightness distribution across obscure lanes in small Hα nebulae are discussed. The peak density is often shifted by a distance of the order of 0.1 pc from the brightness boundary towards the obscure region. The relation with infrared sources is briefly discussed. (FR)

15476 (ESRO-SP-105, pp 19-22) NGC 7635 AND ITS STELLAR NUCLEUS. Viotti, R.; Nesci, R. Nov 1974.
From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).
Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.
In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4-7 June 1974, Frascati, Italy. (European Space Research Organization, 92- Neuilly-sur-Seine (France)).
Observational results concerning NGC 7635 are discussed with special regard to the infrared data. Spectroscopic investigations made at the Asiago and Dominion Astrophysical Observatories show that the exciting star has an 06f spectral type. The emissions are probably variable; the line broadening corresponds to a rotational velocity v sin i = 240 km/s. (FR)

15477 (ESRO-SP-105, pp 23-33) OPTICAL INFRARED AND RADIO OBSERVATIONS OF TWO H II REGIONS. Barlow, M. J.; Cohen, M.; Gull, T. R. Nov 1974.
From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).
Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.
In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4-7 June 1974, Frascati, Italy. (European Space Research Organization, 92- Neuilly-sur-Seine (France)).
A series of broad- and narrow-band photographs of the HII regions NGC 7635/Sh 162 and IC 1470 are presented. In addition to the well-known Bubble a second shell is found to be present in NGC 7635/Sh 162. A 5 GHz map showing the large-scale structure of NGC 7635/Sh 162 is presented. The nebular continuum has been measured at several places in each nebula and is shown to be due to dust-scattered starlight. From the scattered light continuum observations and the variations in extinction found in both nebulae, a very inhomogeneous dust distribution is found. The relation of the exciting stars to the observed infrared emission is discussed. (FR)

15478 (ESRO-SP-105, pp 39-42) INFRARED OBSERVATION OF NGC 6334. Becklin, E. E.; Neugebauer, G. Nov 1974.
From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).
Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.
In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4-7 June 1974, Frascati, Italy. (European Space Research Organization, 92- Neuilly-sur-Seine (France)).
Infrared photometric observations of three components in NGC 6334 have been made. Two of the components are associated with compact H II regions and are similar to the sources in W3. The third component is almost coincident with the OH maser source and shows no known radio continuum emission. A component of the infrared emitting region is less than about 1″ in diameter at 10 μm and shows a strong silicate dust absorption feature. In many respects this source is very similar to the BN infrared source in the Orion Nebula. (FR)

15479 (ESRO-SP-105, pp 43-48) RECENT OBSERVATIONS OF THE 8–13 μm SPECTRA OF H II REGIONS. Aitken, D. K.; Jones, B.; Penman, J. Nov 1974.
From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).
Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.
In H II regions and the galactic center. Proceedings of eighth ESLAB symposium. 4-7 June 1974, Frascati, Italy. (European Space Research Organization, 92- Neuilly-sur-Seine (France)).
The 8-13 μm spectra of a number of compact H II regions are consistent with a simple model of a warm source surrounded by a cold envelope of obscuring material. The same absorption curve applies to the emitting and absorbing matter and appears to be independent of the particular source. Ionized neon has been detected in the galactic center source Sgr A (West), confirming the thermal nature of this source; the neon abundance appears to be normal. (FR)

15480 (ESRO-SP-105, pp 49-51) STRUCTURE OF M17S. Andriesse, C. D.; Koornneef, J. Nov 1974.
From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).
Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.
In H II regions and the galactic center. Proceedings of eighth ESLAB symposium. 4-7 June 1974, Frascati, Italy. (European Space Research Organization, 92- Neuilly-sur-Seine (France)).
The behavior of the 9.7 μm band due to dust particles is studied for some positions within M17S. This source is probably ultraviolet-photon-bound, with cool dust in front. (FR)

15481 (ESRO-SP-105, pp 53-59) WIDE BEAM MEASUREMENTS OF H II REGIONS IN THE INFRARED. Lemke, D. Nov 1974.
From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).
Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.
In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4-7 June 1974, Frascati, Italy. (European Space Research Organization, 92- Neuilly-sur-Seine (France)).
Several of the brighter and more extended H II regions detected by Harper and Low in the far infrared were studied. (FR)

15482 (ESRO-SP-105, pp 61-68) FAR INFRARED PHOTOMETRY OF H II REGIONS. Furniss, I.; Jennings, R. E.; Moorwood, A. F. M. Nov 1974.
From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).
Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.
In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4-7 June 1974, Frascati, Italy. (European Space Research Organization, 92- Neuilly-sur-Seine (France)).
Broadband 40-350 μm fluxes are presented for 56 sources observed with the University College London balloon-born telescope. Within our estimated pointing accuracy, all of these sources can be identified with H II regions. The measured fluxes, together with available radio continuum data, have been used to investigate further the relationship between infrared and radio flux and to estimate effective dust absorption depths and dust-to-gas ratios within the ionized regions. (FR)

15483 (ESRO-SP-105, pp 69-78) FAR INFRARED OBSERVATIONS OF W51 AND THE GALACTIC CENTER. Alvarez, J. A.; Furniss, I.; Jennings, R. E.; King, K. J.; Moorwood, A. F. M. Nov 1974.
From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).
Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.
In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4-7 June 1974, Frascati, Italy. (European Space Research Organization, 92- Neuilly-sur-Seine (France)).
Spectral observations of W51 as well as maps of W51 and the galactic center region in the 40-350 μm band obtained from observations with a 40-cm diameter balloon-born telescope system are presented and discussed. (FR)

15484 (ESRO-SP-105, pp 79-85) HIGH-RESOLUTION MAPS OF H II REGIONS AT FAR-INFRARED WAVELENGTHS. Fazio, G. G.; Kleinmann, D. E.; Noyes, E. L.; Wright, E. L.; Zeilik, M. II; Low, F. J. Nov 1974.
From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).
Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.
In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4-7 June 1974, Frascati, Italy. (European Space Research Organization, 92- Neuilly-sur-Seine (France)).
The first successful flight of a balloon-born 1-m telescope for far-infrared (> 40 μm) astronomy occurred on 4 February 1974 (UT), from Palestine, Texas. During 6h at float altitude, the gyro-stabilised telescope mapped the intensity of far-infrared radiation from the H II regions Ori A and W3 with a resolution of 1′. Partial maps of these regions were made with a resolution of 0.5′. These sources were resolved into several components, some of which were previously unknown. Observations of Mars were used for calibration. (FR)

15485 (ESRO-SP-105, pp 93-99) 1mm OBSERVATIONS OF H II REGIONS. Clegg, P. E.; Ade, P. A. R. Nov 1974.
From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).
Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.
In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4-7 June 1974, Frascati, Italy. (European Space Research Organization, 92- Neuilly-sur-Seine (France)).
The atmosphere plays an important role in determining the mean wavelength of submillimetre observations. Analysis of millimetre and submillimetre fluxes suggests a spectral index of about 3 for several H II regions. If this is interpreted as thermal emission from optically thin dust, the absorption coefficient of the dust grains should vary as lambda^{-1}. The masses of dust required to produce the millimetre emission are moderate. (FR)

15486 (ESRO-SP-105, pp 103-110) NEW OBSERVATIONS OF H II REGIONS AT 7.875, 15.5, 31.4, OR 85 GHz. Johnson, H. M. Nov 1974.
From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).
Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.
In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4-7 June 1974, Frascati, Italy. (European Space Research Organization, 92- Neuilly-sur-Seine (France)).
Observations of about 36 regions are represented as a table of flux densities in one to four frequencies, and also as maps of

selected regions, or as spectral displays of some of them. Comments are also made on most of the material, especially as it relates to previously published data in various frequencies including the infrared. (FR)

15487 (ESRO-SP-105, pp 117-120) HIGH-RESOLUTION STUDY OF THE H II REGION W 3(OH). Harten, R. H. Nov 1974.

From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).

Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.

In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4-7 June 1974, Frascati, Italy. (European Space Research Organization, 92- Neuilly-sur-Seine (France)).

Observations of the H II region W 3(OH) at 6, 21 and 50 cm wavelength indicate that it is a complex of compact sources, embedded in a diffuse extended source. (FR)

15488 (ESRO-SP-105, pp 135-143) EMPIRICAL MODEL FOR THE STRUCTURE OF THE ORION NEBULA. Balick, B.; Gammon, R. H.; Hjellming, R. M. Nov 1974.

From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).

Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.

In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4-7 June 1974, Frascati, Italy. (European Space Research Organization, 92- Neuilly-sur-Seine (France)).

An empirical model of the Orion nebula is proposed whereby a high-density core of ionized gas surrounding the exciting star theta-1 C is partially imbedded on the near side of a massive neutral complex. Radiation from θ-1 C continually ionizes the dense neutral gas, and a network of flows from behind the star and from the north and east result; these resupply high-density gas to the core. The gas freely expands in the other directions where possible through fragments of the original neutral complex producing an extended region of tenuous, swirling nebulosity. It is shown that such a model can explain the large amount of information pertaining to the spatial and kinematic structure of this well-studied nebula. (FR)

15489 (ESRO-SP-105, pp 145-150) NUCLEI AND H II REGIONS IN SPIRAL GALAXIES: PRELIMINARY RESULTS FOR M 101. Benvenuti, P.; D'Odorico, S. Nov 1974.

From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).

Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.

In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4-7 June 1974, Frascati, Italy. (European Space Research Organization, 92- Neuilly-sur-Seine (France)).

The relative intensities of the emission lines Hα, λ6584 of [N II], λ6717, 6731 of [S II] for the nucleus and 10 H II regions of M 101 are given. From the [S II] lines ratio it is found that $N_e = 3000$ cm^{-3} in the nucleus, while N_e is less than 1000 cm^{-3} in the H II regions. The presence of a peculiar structure in the nucleus is revealed. Physical conditions and N/S abundance ratio in H II regions are very close to those obtained for M 33. An upper limit of 4×10^{-16} erg cm^{-2} s^{-1} arc s^{-2} for the surface brightness of the interarm area of M 101 is established. (FR)

15490 (ESRO-SP-105, pp 153-161) EVOLUTIONARY CHARACTERISTICS OF A BIMODAL GRAIN MODEL. Greenberg, J. M.; Seung Soo Hong. Nov 1974.

From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).

Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.

In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4-7 June 1974, Frascati, Italy. (European Space Research Organization, 92-Neuilly-sur-Seine (France)).

A bimodal model of interstellar grains consisting of silicate cores of size 0.06 μm with modified ice mantles of 0.1 μm and very small particles of silicate and/or graphite of size 0.005 μm is followed through various stages of evolution. Starting with a distribution of coremantle cylinders producing average wave length dependence of polarization and extinction, changes in physical and optical characteristics of the model are studied going first into regions of dense cloud condensation and coming out at the other end of star formation into young H II regions. Physical justification is presented to show that not only in dense clouds must one expect the core-mantle grains to be larger than normal, but also in young H II regions. Observational evidence and a preliminary theoretical basis are given for showing that the very small particles that produce the far ultraviolet extinction cannot significantly accrete matter from the gas, even in dense clouds. (FR)

15491 (ESRO-SP-105, pp 163-171) DUST IN H II REGIONS. Panagia, N. Nov 1974.

From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).

Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.

In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4-7 June 1974, Frascati, Italy. (European Space Research Organization, 92-Neuilly-sur-Seine (France)).

The effects of the presence of dust inside H II regions have been studied by means of theoretical models of dusty nebulae. Recent infrared observations have been analysed and clear evidence that the emitting dust is mostly mixed ionized gas has been found. Some information about the amount, distribution and properties of dust grains has also been derived. (FR)

15492 (ESRO-SP-105, pp 173-178) IONIZATION STRUCTURE AND TRANSFER OF RADIATION IN DUSTY NEBULAE. Petrosian, V. Nov 1974.

From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).

Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.

In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4-7 June 1974, Frascati, Italy. (European Space Research Organization, 92- Neuilly-sur-Seine (France)).

Analytic expressions describing the infrared radiation and hydrogen to helium line intensity ratios from a dusty nebula are presented. Implications of these results are discussed briefly. (FR)

15493 (ESRO-SP-105, pp 179-184) EXPECTED FAR INFRARED POLARIZATION OF H II REGIONS AND THE NUCLEI OF GALAXIES. Harwit, M. Nov 1974.

From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).

Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.

In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4-7 June 1974, Frascati, Italy. (European Space Research Organization, 92-Neuilly-sur-Seine (France)).

The expected polarization of far-infrared sources is discussed and it is shown that the observed degree of polarization generally depends on two factors: the availability of a mechanism that can produce polarization, and the gain in polarization which absorption or stimulated emission can produce within a source. That stimulated emission could produce sizeable gain changes in compact dust clouds such as those associated with H II regions and possibly also in dense regions exhibiting OH and H_2O masers. Whether such a gain can actually become positive (maser-like behavior) is not clear, but this would in any case depend on the chemical structure of the grain material and the spectral range of interest. (FR)

15494 (ESRO-SP-105, pp 185-190) CALCULATION OF INFRARED SPECTRA FROM DUST IN PLANETARY NEBULAE. Epchtein, N.; Baluteau, J. P.; Bussoletti, E. Nov 1974.

From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).

Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.

In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4-7 June 1974, Frascati, Italy. (European Space Research Organization, 92-Neuilly-sur-Seine (France)).

Middle- and far-infrared excess from planetary nebulae is due to thermal re-emission of stellar ultraviolet radiation by dust grains. Calculations of grain temperature have been performed by Krishna Swamy and O'Dell [1968] for NGC 7027, and for a large number of planetary nebulae by Terzian and Sanders [1972]. Their calculations have been repeated and their method has been improved. (FR)

15495 (ESRO-SP-105, pp 191-194) GAS-TO-DUST RATIO IN THE ORION NEBULA. Perinotto, M.; Patriarchi, P. Nov 1974.

From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).

Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.

In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4-7 June 1974, Frascati, Italy. (European Space Research Organization, 92-Neuilly-sur-Seine (France)).

About sixty spectra have been obtained using an image tube with the nebular spectrograph of the Asiago 122cm reflector, in a position W-E from north of the Trapezium across the star P 1925 into the bay area of the Orion Nebula. Twenty-five spectra have been selected for accurate measurements of the Hβ intensity and of the electron density by the [S II] 6730/6716 intensity line ratio. The results are interpreted in terms of well-mixed gas and dust, not only in the central bright regions, but even in the bay area, where the coefficient of dust extinction counted per electron is found to be larger than in the bright center of the nebula. (FR)

15496 (ESRO-SP-105, pp 203-207) CO MAPPING OF 100μm SOURCES ASSOCIATED WITH DARK CLOUDS: PRELIMINARY RESULTS. Simon, M.; Simon, M. N. Nov 1974.

From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).
Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.
In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4–7 June 1974, Frascati, Italy. (European Space Research Organization, 92–Neuilly-sur-Seine (France)).

The present evidence indicates that the submillimeter radiation that has been detected from galactic sources is thermal radiation from dust within these sources. Since molecules seem to be associated with such regions of dust and gas. A program of CO mapping observations of 100μm sources that have been detected in the several airborne surveys in order to study the temperature, optical depth, and excitation conditions in these sources is in preparation. The sources HFE2, 9, 10, and 11 and FJM3 are being mapped. CO has been at or near all the 100μm sources (with the exception of HFE 10 and 11), and the sources appear to be associated with small dark clouds. (FR)

15497 (ESRO-SP-105, pp 221-225) DUST IN THE GALACTIC CENTER. Greenberg, J. M.; Seung Soo Hong. Nov 1974.
From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).
Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.
In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4–7 June 1974, Frascati, Italy. (European Space Research Organization, 92–Neuilly-sur-Seine (France)).

The strength of the 0.7μm absorption band in the radiation from the galactic center is used to deduce a range of measures of the visual extinction from 20 to 400 magnitudes. A possible way of arriving at a unique value of the visual extinction consistent with variations in the wavelength dependence of extinction as a function of grain characteristics is indicated. The mass of silicates deduced from the 9.7μm band appears to imply a gradient of metallicity towards the galactic center. (FR)

15498 (ESRO-SP-105, pp 229-233) DOMINANT 10-20μm SOURCE IN THE GALACTIC CENTER. Borgman, J.; Koornneef, J.; Vries, M. de. Nov 1974.
From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).
Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.
In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4–7 June 1974, Frascati, Italy. (European Space Research Organization, 92–Neuilly-sur-Seine (France)).

The dominant 10-20μm source in the galactic center is a 4″ x 6″ object, coinciding with a compact radio source. It is suggested that the radiation is due to dust, which competes efficiently with the hydrogen to capture Lyman-continuum photons, or that the dust is heated by protostars which are just becoming hot enough to start ionizing the hydrogen. (FR)

15499 (ESRO-SP-105, pp 235-238) MULTICOLOUR FAR-INFRARED PHOTOMETRY OF THE GALACTIC CENTER REGION. Olthof, H. Nov 1974.
From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).
Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.
In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4–7 June 1974, Frascati, Italy. (European Space Research Organization, 92–Neuilly-sur-Seine (France)).

Results are presented of far-infrared photometric measurements of the galactic center region. The observations have been made in two wavelength bands simultaneously, during balloon flights conducted in the south of France in 1972 and 1973 in co-operation with CNES. (FR)

15500 (ESRO-SP-105, pp 239-245) INFRARED RADIATION MODEL FOR THE GALACTIC CENTER. Andriesse, C. D. Nov 1974.
From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).
Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.
In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4–7 June 1974, Frascati, Italy. (European Space Research Organization, 92–Neuilly-sur-Seine (France)).

A model is discussed which details the general view that the infrared radiation from the galactic center region originates from interstellar dust heated by stellar radiation. Its ingredients are the stellar mass model for the galactic center devised by Sanders and Lowinger, and Spinrad's model for the stellar population in the nucleus of M31. Furthermore, a simple theoretical oscillator model is used for the infrared radiative properties of dust particles. Some qualitative remarks are made regarding the treatment and its approximations. Though the study is not yet complete, the following preliminary conclusions are possible. There will be a dense core with particle temperatures probably in excess of 1000K and a halo where the temperature is below 100K and falls off rather slowly with the distance, looking in the direction of the center, the spectrum peaks at about 50μm because of the halo contribution in front of the core. The halo also causes the absorption of the 9.7μm resonance in the particles. The depth of the 9.7μm band does not change much for various directions through the galactic center region. Compared to the solar neighborhood, the dust-particle mass is relatively small. We expect the size and composition of the particles to change through the region. (FR)

15501 (ESRO-SP-105, pp 247-256) RECENT RADIO OBSERVATIONS OF THE GALACTIC CENTER. Downes, D. Nov 1974.
From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).
Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.
In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4–7 June 1974, Frascati, Italy. (European Space Research Organization, 92–Neuilly-sur-Seine (France)).

Recent radio continuum observations of the galactic center region made at Cambridge, Westerbork and Bonn are reviewed. The new maps show considerable fine structure in the sources G1.1-0.1, G0.9+0.1, G0.7–0.0 (Sgr B2), G0.5 – 0.0, G0.2 – 0.1 and G359.4 – 0.1. The observations of Sgr A confirm the general division into two sources: a thermal component of diameter 45″ which surrounds the galactic nucleus, as defined by the maximum surface brightness at 2.2μm, and a nonthermal component of diameter 150″ which may be a supernova remnant. Five sources smaller than 10″ are found within a 5′ × 5′ field centered on Sgr A. A radio source of angular diameter <0.1″ may be the actual nucleus of the galaxy. (FR)

15502 (ESRO-SP-105, pp 257-260) OBSERVATIONS OF NEUTRAL HYDROGEN IN THE REGION 355 DEG $< l^{II} <$ 10 DEG AND -5 DEG $< b^{II} <$ 5 DEG. Cohen, R. J.; Pedlar, A. Nov 1974.
From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).
Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.
In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4–7 June 1974, Frascati, Italy. (European Space Research Organization, 92–Neuilly-sur-Seine (France)).

Studies of the 21cm hydrogen line from the central regions of the Galaxy are reported. The instruments used for the study are the Mark II (31′ x 35′ HPBW) and Mark IA (13′ HPBW) radio telescopes at NRAL, Jodrell Bank. (FR)

15503 (ESRO-SP-105, pp 261-265) INTENSE SUB-ARCSECOND STRUCTURE IN THE GALACTIC CENTER. Balick, Bruce; Brown, R. L. Nov 1974.
From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).
Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.
In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4–7 June 1974, Frascati, Italy. (European Space Research Organization, 92–Neuilly-sur-Seine (France)).

The detection of strong radio emission from bright (brightness temperature $\geq 10^7$K), unresolved ($\theta \leq 0.1''$) structure in the inner 1pc core of the galactic nucleus is reported. (FR)

15504 (ESRO-SP-105, pp 267-272) EXPECTED INFRARED MOLECULAR LINES FROM THE GALACTIC CENTER. Bussoletti, E. Nov 1974.
From 8th ESLAB symposium; Frascati, Italy (4 Jun 1974).
Published by ESRO Scientific and Technical Information Branch. c/o ESTEC, Noordwijk, Netherlands.
In H II regions and the galactic center. Proceedings of eighth ESLAB symposium, 4–7 June 1974, Frascati, Italy. (European Space Research Organization, 92–Neuilly-sur-Seine (France)).

Expected intensities (at Earth) of rotational H_2 and HD lines are computed for Sgr A and Sgr B2 clouds. Radio molecular data are used to compute the half-widths of these lines. It is shown that some lines are detectable with present infrared techniques. Their observation will provide the first direct estimate of masses and of the D/H ratio in very dense clouds. (FR)

15505 (INIS-mf-1858) SPIRAL STRUCTURE AND THE DYNAMICS OF FLAT STELLAR SYSTEMS. Dekker, E. (Rijksuniversiteit Leiden (Netherlands)). 16 Apr 1975. 148p. INIS.
Thesis.

Two problems left over by the Lin and Shu theory are studied: how can spiral structures with longer lives than 10^9 years be explained; what determines the frequency of the spiral waves as observed. It is shown with the aid of numerical experiments that the gas through its interaction with the expanding wave exercises a stabilizing influence on that wave. This results in an equilibrium attained in about 5.10^9 years, in which the wave persists with a certain finite amplitude. A more sophisticated quasi-linear theory, inspired by kindred developments in plasma physics, confirms

this result. However, it also shows that after a very long time—1 to 2.10^{10} years—the wave will be damped. The spiral structure originates in an instability in the stellar population. The final form and the amplitude of the density wave depend on the dynamical properties of the stellar disk, on the structure of the gaseous masses, and on the mass ratio between the gas and the stars. (auth)

15506 SIZE OF THE COMA CLUSTER. Chincarini, G. (Univ. of Oklahoma, Norman); Rood, H. J. Nature (London); 257: No. 5524, 294-295(25 Sep 1975).

The studies reported were concentrated on a region 5° to 13° west of the center of the Coma cluster, using spectrograms obtained with a Carnegie image tube on the 2.1 m telescope at the Kitt Peak National Observatory. The results indicate that if the Coma cluster is a fairly typical cluster, as it seems to be, it has a mass $\geq 1.3 \times 10^{15}$ $M_\odot$ and that its radius is at least 5°. (UK)

15507 MeV GAMMA RADIATION FROM THE CRAB NEBULA. Schoenfelder, V.; Lichti, G.; Moyano, C. (Max-Planck-Institut fuer Physik und Astrophysik, Garching, Ger.). Nature (London); 257: No. 5525, 375-376(2 Oct 1975).

It is stated that some recent results from balloon experiments indicated that the γ-ray emission from the Crab Nebula between 1 and 10 MeV is considerably above the straight line interpolations from lower and higher photon energies. Results of a balloon flight by the present authors, using a double Compton telescope, however, have given an upper limit to the soft γ-ray flux between 1.5 and 10 MeV which contradicts the flux values previously published and rules out the existence of an excess, at least of the published magnitude. A description is given of the apparatus used and its mode of operation. (UK)

15508 ^{22}Na, Ne-E, EXTINCT RADIOACTIVE ANOMALIES AND UNSUPPORTED ^{40}Ar. Clayton, D. D. (Rice Univ., Houston, TX). Nature (London); 257: No. 5521, 36-37(4 Sep 1975).

A new picture has been put forward concerning the origin of known extinct radioactivities, notably ^{129}I and ^{244}Pu. This holds that these radioactive species were precipitated in grains forming in the rapidly cooling ejecta of explosive nucleosynthesis, and that their decay occurred in interstellar grains rather than in meteorites (Clayton, Astrophys. J. 199: 765(1975)). If this is so, previous interpretations of extinct radioactivities are modified; their detectability is no longer related to the usual criterion that they live long enough for formation of meteorites to occur, but rather that they live long enough for grains to form in the expanding envelope. This picture is here applied to ^{22}Na, ^{22}Ne, unsupported ^{40}Ar, and other species, and to extinct radioactive anomalies. (UK)

15509 STRUCTURE OF THE COMPACT RADIO COMPONENT IN 3C236. Fomalount, E. B. (National Radio Astronomy Observatory, Green Bank, WV); Miley, G. K. Nature (London); 257: No. 5522, 99-103(11 Sep 1975).

The compact component in the giant radio galaxy 3C236 has been studied at 0.4, 2.7, and 8.1 GHz, with resolution of up to 0.13″. The overall structure is double and asymmetric. The extent is 0.8″ in a position angle of 121 ± 4° which, within the uncertainties, is the same as that of the large outer 39′ double. On a scale of 0.2″ there is a fine structure. The radio subcomponents are almost certainly not confined and are thus the results of a relatively recent event in the nucleus of 3C236. The results are compatible with continuous flow models which are well collimated along an axis whose alignment does not change significantly during the lifetime of the source. (auth)

15510 FORMALDEHYDE POLYMERS IN INTERSTELLAR SPACE, AND REPLY. Fawcett, A. H. (Queen's Univ., Belfast); Wickramasinghe, N. C.; Santhanan, K. S. Nature (London); 257: No. 5522, 159(11 Sep 1975).

Some criticisms are offered on the suggestion of Wickramasinghe that polyoxymethylene (POM) crystals exist in interstellar space, in equilibrium with formaldehyde. The criticisms are made in terms of the thermodynamics of polymer-monomer equilibria. It is considered doubtful if the infrared emission observed from certain nebulae is from a POM source. A reply by Wickramasinghe is appended. (UK)

15511 ARE NEARBY SMALL GROUPS OF GALAXIES EXPANDING WITH THE UNIVERSE. Jackson, J. C. (Leicester Univ., Eng.). Mon. Not. R. Astron. Soc.; 173: No. 1, 41P-46P (Oct 1975).

Turner and Sargent have argued that many of the small groups of galaxies catalogued by de Vaucouleurs have crossing-times of the order of the Hubble time, and hence are probably unbound systems expanding as the Universe expands. It is shown that they used an inappropriate definition of crossing-time, and that the properly defined crossing-times are typically about 20 percent of the Hubble time. (auth)

Cosmology

Refer also to abstracts 15432, 15511, 15524, and 15693.

15512 IS THE UNIVERSE OPEN OR CLOSED. Audouze, J. Recherche (Paris); 6: No. 56, 462-465(May 1975). (In French)

The galaxies recede at a velocity which is not constant but decreases with time. The universe expansion is decelerating at a rate depending on whether an open or closed universe model is adopted. In a closed universe the gravitational attraction potential is higher and deceleration much faster than in an open system, where it is negligible. An estimate of the present density of the universe would show which model applies. The abundance of deuterium seems to be the most important parameter of this discussion. (FR)

15513 SOME MAGNETO-HYDRODYNAMIC UNIVERSES OF GOEDEL TYPE. Bray, M. (Centre National de la Recherche Scientifique, 75—Paris (France)). Ann. Inst. Henri Poincare, Sect. A; 22: No. 1, 29-42(1975). (In French)

Given a Goedel type metric tensor $g_{\alpha\beta}$ some solutions of the Einstein gravitational field equations are obtained for a total energy tensor corresponding to the magneto-hydrodynamic case. (FR)

15514 CURVES GIVING THE AGE OF THE UNIVERSE IN FRIEDMANN MODELS. Campusano, L.; Heidmann, J. (Observatoire de Paris, Section de Meudon, 92 (France)); Nieto, J. L. (Centre National de la Recherche Scientifique, 75 – Paris (France). Inst. d'Astrophysique). Astron. Astrophys.; 41: 229-231(1975).

1 fig.; 1 tab.; 4 refs.

We give a set of curves $H_0 t_0$ = constant in the observationally relevant region of the (log σ_0, λ_0) plane, where H_0 is the Hubble constant, t_0 the age of the universe, σ_0 the density parameter and λ_0 the reduced cosmological constant. From the analysis of the observational data on H_0, t_0, and σ_0, we provide an upper limit to the cosmological constant. (DE)

15515 OBSERVABLE ASPECTS OF VERY LONG WAVELENGTH GRAVITATIONAL WAVES. Jackson, J. C. (Leicester Univ., Eng.). Mon. Not. R. Astron. Soc.; 173: No. 1, 5P-8P(Oct 1975).

The interaction of very long wavelength gravitational waves with clusters of galaxies is considered. These waves induce oscillatory relative motions within such systems, as well as a systematic expansion. (auth)

15516 COSMOLOGICAL MODEL WITH EXPANSION, SHEAR, AND VORTICITY. Batakis, N.; Cohen, J.M. (Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania 19174). Phys. Rev. D 12: No. 6, 1544-1550 (15 Sept 1975).

A homogeneous, cosmological model with expansion, shear, and small vorticity is presented. For large times vorticity and anisotropy become small. An expression is derived for the temperature and red shift of blackbody radiation for spatially homogeneous spacetimes. It is used to study the effect of shear and vorticity on the background microwave radiation in the open model presented here. Gödel's theorem on galaxy counts in closed rotating universes is generalized to include open models as well. (auth)

15517 NUMERICAL EXAMPLES FROM PERTURBATION ANALYSIS OF THE MIXMASTER UNIVERSE. Hu, B.L. (Department of Mathematics, University of California, Berkeley, California 94720). Phys. Rev. D 12: No. 6, 1551-1562 (15 Sept 1975).

Tensor perturbations in a closed anistropic empty (mixmaster) universe is studied. Numerical solutions of the perturbation equations for the lowest inhomogeneous mode are given for some characteristic regimes of the background dynamics. The mixmaster universe is shown to be stable in this mode against gravitational perturbations. Growth of perturbations in the contraction of the universe shows the characteristic mixmaster-type oscillatory approach to singularity. (auth)

15518 SPHERICAL MASS IMMERSED IN A COSMOLOGICAL UNIVERSE: A CLASS OF SOLUTIONS. II. Eisenstaedt, J. (Laboratoire de Physique Théorique, Institut Henri Poincaré, 11, rue Pierre et Marie Curie, 75231 Paris Cedex 05). Phys. Rev. D 12: No. 6, 1573-1575 (15 Sept 1975).

In a previous paper we considered what we called a "two-regions solution." We developed the exact and general solution of a spherical mass embedded in a cosmological fluid, the material tensor of each region being described by a perfect fluid with a mass density depending on the time only. We generalize that solution to an n-layer model, the central object being represented for example by the $(n-1)$ first layers, the last one describing the cosmos. (auth)

Planetary Phenomena

Refer also to abstract 15900.

15519 (N-75-14692) PRE-MARE CRATERING AND EARLY SOLAR SYSTEM HISTORY. Wetherill, G. W. (California Univ., Los Angeles (USA). Dept. of Planetary and Space Science). 1974. 43p. (NASA-CR-141254). NTIS $3.75.

From Soviet-American conference on the cosmochemistry of the Moon and planets; Moscow, USSR (4 Jun 1974).

An evaluation of the application of the high extra-lunar flux in pre-mare times to more general problems of early solar system history is attempted by combining the results of dynamic studies with lunar chronological data. Dynamical studies permit separate evaluation of the possible sources for both the normal flux during the first 600 m.y. years of lunar history as well as the peak which apparently occurred 4.0 b.y. ago. Dynamical studies have been carried out in order to determine the extent to which a heliocentric flux could be confined to the Moon (and Earth). A Monte Carlo method has been used to calculate the relative impact rates of planet-crossing bodies with the moon and the terrestrial planets. It is concluded that the time-variation of the flux on these planets is closely related to that on the moon. (STAR)

15520 (N-75-14693) COMETS: DATA, PROBLEMS, AND OBJECTIVES. Whipple, F. L. (Harvard Univ., Cambridge, Mass. (USA). Center for Astrophysics). 1974. 17p. (NASA-CR-141241). NTIS $3.25.

From Soviet-American conference on the cosmochemistry of the Moon and planets; Moscow, USSR (4 June 1974).

Relevant results from the observations of Comet Kohoutek are presented with an outline summary of basic knowledge concerning comets, both subjects being confined to data related to the nature and origin of comets rather than the phenomena (for example, plasma phenomena are omitted). Places of cometary origin in the developing solar system are discussed, along with the proto-Uranus-Neptune region versus the much more distant fragmented interstellar cloud region, now frequented by comets of the Opik-Oort cloud. The Comet Kohoutek results add new insights, particularly with regard to the parent molecules and the nature of meteoric solids in comets, to restrict the range of the physical circumstances of comet formation. (STAR)

15521 COSMOGENIC EXCESS OF ^{40}K AND THE FLUX OF FAST NEUTRONS IN METEORITES. Stegmann, W.; Begemann, F. (Max-Planck-Institut fuer Chemie (Otto-Hahn-Institut), Mainz (F. R. Germany)). Z. Naturforsch., A; 30: No. 8, 968-975(Aug 1975). (In German).

4 figs.; 4 tabs.; 27 refs.

Results are reported of a mass spectrometric investigation of the content and isotopic composition of potassium from the mesosiderite Emery (silicate phase) and the chondrite Elenovka (bulk). Normalized to the Nier value of $^{39}K/^{41}K = 13.47$, the ^{40}K in Emery (K-content 220 ± 25 ppm) was found to be enriched by (4.03 ± 0.30)%, the potassium from Elenovka (760 ± 50 ppm) to be indistinguishable from terrestrial potassium. Evidence is presented that the excess ^{40}K in the silicates from Emery (Ca-content 6.06 wt.%) has been produced essentially by secondary cosmic ray neutrons via the $^{40}Ca(n,p)$-reaction. The total excess of $(2.57 \pm 0.39) \times 10^{14}$ ^{40}K-atoms/gCa together with the excitation function of the $^{40}Ca(n,p)$-reaction and the neutron flux spectrum of Arnold, Honda, and Lal yields a dose of fast neutrons ($2\ MeV \leq E_n \leq 100\ MeV$) $\Phi \times T = (7.2 \pm 1.1) \times 10^{16}$ neutrons/cm^2 and an average flux during the cosmic ray exposure age T = (134 ± 12) Myrs of $\Phi = (17.4 \pm 3.1)$ neutrons/cm^2 sec. (DE)

15522 ANOMALIES IN THE NATURAL ABUNDANCE OF ^{239}Pu. Meier, H.; Boesche, D.; Zeitler, G.; Albrecht, W.; Hecker, W.; Menge, P.; Unger, E.; Zimmerhackl, E. (Staatliches Forschungsinstitut fuer Geochemie, Bamberg (F. R. Germany)). Radiochim. Acta; 21: No. 1, 110-116(1974). (In German).

8 figs.; 5 tabs.; 65 refs.

Volcanic samples from different locations and eruptions were found to have uranium contents in the range from 0.1 to 2 ppM and ^{239}Pu contents of the order of 10^{-14} g/g, as measured by α spectrometry. Thus the corresponding $^{239}Pu/^{238}U$ ratios reach values up to 10^{-7}, several orders of magnitude higher than the value of 3×10^{-12}, which is typical for uranium minerals. These results agree with those of Cherdyntsev et al., who found $^{239}Pu/^{238}U$ ratios up to 10^{-5} in volcanic samples. A contamination by ^{239}Pu from fallout is out of the question. Build-up from ^{238}U by neutron capture cannot provide an explanation on the basis of the neutron flux densities normally supposed to exist in the crust of the earth, at least as long as one may not assume natural chain reactions of the type of the prehistoric Oklo "nuclear reactor" to occur near volcanic magmas. In this connection, the possible relation between ^{239}Pu anomalies and the natural occurrence of super-heavy elements, as discussed by Cherdyntsev et al., gains a new interest. (DE)

15523 GHOST ECHOES ON THE EARTH–MOON PATH. Rasmussen, H. L. (Amateur Radio 0Z9CR, Asum Odense, Denmark). Nature (London); 257: No. 5521, 36(4 Sep 1975).

The appearance of strange delayed echoes on 7 July 1974, whilst using a "moon bounce" technique at 1,296 MHz, is reported. The equipment consisted of a parabolic antenna, 26 ft. in diameter, with a circularly polarised feed horn driven with a 500 w continuous wave from a transmitter. On the day in question a series of dots or a single dash was being reflected back from the Moon after an interval of 2.6 sec. A second signal suddenly appeared, delayed by about 2 sec. This signal has the same characteristics as the normal signal, except that it was weaker. Throughout a series of transmissions the returning Moon signal was followed about 2 sec later by the delayed "ghost signal". The following day a severe radio blackout occurred, lasting for several days, and was coincident with the appearance of a large sunspot. Relating this reception of the "ghost" echo with the violent solar eruption it is suggested that the large streamer of gas from the solar corona produced a highly ionized cloud that reflected the radio signals directed towards the Moon. (UK)

15524 EXPERIMENT TO DETECT THE SPATIAL VELOCITY OF THE EARTH. Mora, D. J. Mon. Not. R. Astron. Soc.; 173: No. 1, 33-36(Oct 1975).

The knowledge which is now available concerning the solar galactic velocity makes it possible to perform an astronomical alternative to physical experiments for testing special relativity. This astronomical method could also be used to check some observations made in a previous Michelson–Morley type experiment which were at variance with the null results generally obtained. (auth)

15525 STABILITY OF THE SOLAR SYSTEM AND OF SMALL STELLAR SYSTEMS. Proceedings of Symposium Held at Warsaw, Poland, September 5–8, 1973. Kozai, Y. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974). 309p. (In French and English). (A-75-21601). $38.30.

Recent theoretical works on the dynamical evolutions of planetary and satellite systems, the asteroid problem, the stability of small stellar systems, and qualitative methods of dynamical systems in astronomy are presented. Some of the topics covered include the original distribution of the asteroids, stability of asteroidal motion in the Hecuba gap, stationary solutions of the averaged three-body problem and some problems of planet motion stability, the calculation of secular perturbations in the case of close commensurability, the role of binaries in cluster dynamics, and numerical experiments on expanding gravitational systems. (IAA)

PHYSICS (ATMOSPHERIC)

Refer also to abstracts 15453, 15523, 15539, 15541, and 15703.

15526 NONLINEAR SATURATION OF STIMULATED DIFFUSION SCATTERING. Weinstock, J.; Rognlien, T.D.; Lee, K.F. (Aeronomy Laboratory, National Oceanic and Atmospheric Administration, Boulder, Colorado 80302). Phys. Fluids 18: No. 12, 1734-1739 (Dec 1975).

A nonlinear instability theory is presented for stimulated scattering of electromagnetic ordinary-mode radiation from electrostatic "diffusion modes." These "diffusion modes" are excited unstable by the incident radiation, and have their linear damping rates proportional to the diffusion tensor. Two diffusion modes are found; one corresponds to thermal diffusion and the other to particle diffusion. The thermal diffusion mode was previously calculated by Berger, Goldman, and DuBois for a two-dimensional model. The present calculation is made for three dimensions to show that the radiation is scattered over a wide angle in the plane perpendicular to a uniform magnetic field. A three-dimensional model is necessary to determine nonlinear effects. The saturated level of the electrostatic diffusion modes is calculated explicitly. For ionospheric modification experiments it is found that the electron density fluctuations are almost 1% of the ambient electron density. (auth)

Auroral and Ionospheric Phenomena

15527 (AD/A-005175) POLAR CAP ABSORPTION IN ANTARCTICA IN 1967. Khodzha-Akhmedov, Ch. L. Translated from Tr. Sov. Antarkt. Eksped.; 47: 162-170([nd]). 11p. (FSTC-HT-23-1218-73). NTIS $3.25.

Polar cap absorption (PCA) was investigated from January to May of 1967. It was found that PCA follows a daily course, generating the most radio noise at midday when the sun's altitude is highest. During absorptive periods, radio communications were disturbed and, in some cases, completely absent. However, data contradicting this observation are reported. In spite of this, the absorptive region was formed below the region of scattering. (GRA)

15528 (AD/A-006200) MOMENT METHOD SOLUTIONS FOR THE IMPEDANCE OF ASYMMETRICALLY DRIVEN rf PROBES IN THE COLLISIONAL IONOSPHERIC MAGNETOPLASMA. Hwang, H. (Utah State Univ., Logan (USA). Space Science Lab.). Aug 1974. Contract F19628-72-C-0255. 176p. NTIS $7.00.

In order to ascertain the electron density in the earth's ionosphere by direct measure a radio frequency (RF) impedance probe technique has proved useful. This technique involves monitoring the changes in impedance of an antenna mounted on a rocket or satellite vehicle traversing the ionospheric regions of interest. The changes of antenna impedance can be related to the electron density of the surrounding plasma through use of suitable theoretical development of the antenna-plasma interaction. It is the purpose of this treatise to develop a more general expression for the impedance of an antenna in the ionosphere to be useful as an RF probe for measurement of electron density. The investigation of ionospheric plasma characteristics by means of such RF probes has received a great deal of attention since the advent of the rocket allowed direct measurements within the ionosphere. (GRA)

15529 (AD/A-006444) EARLY HISTORY OF IONOSPHERIC INVESTIGATIONS IN THE UNITED STATES. Waynick, A. H. (Office of Naval Research (USA). London Branch Office). 27 Dec 1974. 30p. (ONRL-R-15-74). NTIS $3.75.

The early history of ionospheric investigations in the US from the first suggestion of its existence by Kennelly to the initial data procured with rockets is outlined. A tabulation of the earlier groups and organizations in this field is followed by brief historical outlines of the work in certain technological and scientific areas. The report is concluded with an enumeration of several of the ionospherically related US activities following the early 1950's. (GRA)

15530 (TRITA-EPP-75-10) DOUBLE LAYERS. Block, L. P. (Kungliga Tekniska Hoegskolan, Stockholm (Sweden). Institutionen foer Plasmafysik). May 1975. 22p. (CONF-750461-4). Dep. NTIS (US Sales Only) $3.50.

From the nobel symposium on the physics of the hot plasma in the magnetosphere; Kiruna, Sweden (2 Apr 1975).

The basic properties of electrostatic double layers observed in laboratory gaseous discharges are reviewed. Theoretical results from both macroscopic (4-fluid) theory and microscopic (Vlasov) theory are described and found to be in fairly good agreement. Recent work on Penrose-stable double layers, as well as double layers with oblique electric and magnetic fields are described. Applications to Birkeland currents in the ionosphere are made. It is found that kilovolt potential drops along the geomagnetic field can be produced in the topside ionosphere by double layers. Anomalous (turbulent) resistivity effects are unlikely to produce large parallel potential drops since that would lead to excessive heating of the ambient plasma. Since double layers are laminar structures they will not produce heat until the accelerated particles are stopped in the lower much denser E-layer. (auth)

15531 INFLUENCE OF THERMOSPHERIC WINDS AND ELECTRIC FIELDS ON ELECTRON DENSITY DISTRIBUTION IN THE REGION F2 ABOVE ITS MAXIMUM AT MIDDLE LATITUDES. Fatkullin, M. N.; Kozlov, V. K. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Izv. Vyssh. Uchebn. Zaved., Radiofiz.; 18: No. 6, 864-868(1975). (In Russian).

The influence of electric fields and thermospheric winds on the electron density distribution n_e at the heights of region F2 above its maximum ($h > h_m F2$ where h_m F2 is the heights of the maximum layer of F2) is studied by analyzing the asymptotic solution of the discontinuity equation. At the heights $h \gtrsim 500$ km the electric fields and thermospheric winds are shown not to affect the electron density distribution. (auth)

15532 GALACTIC X-RAY SOURCES AND THE IONOSPHERIC D REGION. Karszenbaum, H. (Nacional La Plata Univ., Argentina); Gagliardini, D. A. Nature (London); 257: No. 5521, 34-35(4 Sep 1975).

It is stated that the possible influence of galactic point x-ray sources in the ionospheric D region has received some attention. Observed variabilities in phase and amplitude of very low frequency night-time propagation have been attributed to different ionization sources, and the relationship between the appearances of strong x-ray sources and the recorded vlf phase and intensity variations has been emphasized. These effects are particularly evident for Sco X-1, Cen X-2, and Cen X-4. Theoretical ionization rates are here calculated for energies up to 50 keV, including non-constant photoionization yields and data from the latest available measured spectra, and an expression is derived for the total electron production rate attributable to a celestial x-ray source. Previous calculations assumed a constant photoionization and energies up to only 10 keV, and these calculations do not include all the energy ranges available in the measured spectra, leading to the suggestion that the contribution of point x-ray sources to the total in production of the D region is small. The new results support claims that there is a Sco X-1 effect on the vlf propagation and similar conclusions could be drawn for Cen X-2 and Cen X-4. (UK)

15533 DURATION OF EQUATORIAL SPREAD F. Somayajulu, V. V.; Gupta, K. S.; Murthy, B. V. K. (Vikram Sarabhai Space Centre, Trivandrum, India). Nature (London); 257: No. 5522, 112-113(11 Sep 1975).

It is stated that it is well established that the spread-F phenomenon, which is observed on ionograms as diffuse echoes, is a common night time feature between dip latitudes 20°N and 20°S, and its morphological features have been reported for several equatorial stations. The equatorial spread usually starts around the time of reversal of the F-region vertical motion in the evening and grows in intensity during the downward motion of the F-region. Spread-F normally persists for only a few hours, but occasionally continues throughout the night, and sometimes after disappearance in the pre-midnight period it reappears in the past-midnight period. Published ionospheric data for the year 1970 were examined to study factors influencing the duration of spread-F, and the results are here presented. Agreement was good between observed and estimated spread-F. It is suggested that the electrodynamic drift caused by an east-west electric field is one of the prerequisites of spread-F generation and sustaining mechanisms, and that turbulent electric fields in the F-region could be a necessary condition for equatorial spread-F. (UK)

15534 SHORT TERM RELATIONSHIPS BETWEEN SOLAR FLARES, GEOMAGNETIC STORMS, AND TROPOSPHERIC VORTICITY PATTERNS. Olson, R. H. (Univ. of Colorado, Boulder). Nature (London); 257: No. 5522, 113-115(11 Sep 1975).

It has been found that the 500 mbar vorticity area index (VAI) is a rough measure of the strength of the cyclonic activity over the Northern Hemisphere, and that it is affected by solar flares

in at least two ways. First, there is an increase in the VAI during the first two days after the flare; then, after the geomagnetic storm that often follows a major solar flare, there is a sharp decrease in the VAI. This is consistent with the results of earlier studies on the development of pressure troughs in the North Pacific area. Short term relationships between variable solar activity and weather have been reported, but these relationships have often been unconnected and even contradictory. The results reported here, however, seem to form a logical extension of results recently reported. The experimental methods employed are described in detail. (UK)

15535 WHISTLER-MODE SIGNALS: GROUP DELAY BY CROSS CORRELATION. Thomson, N.R. (Physics and Engineering Laboratory, Department of Scientific and Industrial Research, Lower Hutt, New Zealand). Geophys. Res. Lett. 2: No. 10, 451-452 (Oct 1975).

Group travel times of 18.6 kHz whistler-mode signals from NLK, Seattle, to Wellington, New Zealand, are now being measured using the normal FSK transmissions. This is done using a mini-computer programmed to perform real-time cross correlations between two receivers: one receiver gets its signal from a whip aerial on which the ground wave (subionospheric mode) dominates, while the other gets its signal from a loop oriented for minimum ground wave. Group travel time can thus be measured continuously while there are whistler-mode signals present. Delays of 0.2–0.8 seconds have been found. (auth)

15536 MODEL OF BIRKELAND CURRENTS ASSOCIATED WITH AN AURORAL ARC. Vondrak, R.R. (Department of Space Physics and Astronomy, Rice University, Houston, Texas 77001). J. Geophys. Res. 80: No. 28, 4011-4014 (1 Oct 1975).

The ionospheric configuration of the vertical Birkeland currents associated with an auroral arc is calculated from a model based on the assumption that the auroral electrons constitute a net current into the ionosphere. It is further assumed that the return vertical current out of the ionosphere is impeded along the field lines which connect the arc to the magnetosphere. The magnitude, location, and structure of the return Birkeland current calculated from the model agree well with measurements of these parameters by a rocket-borne experiment. (auth)

15537 EVIDENCE THAT THE ELECTROSTATIC ION CYCLOTRON INSTABILITY IS SATURATED BY ION HEATING. Kelley, M.C. (School of Electrical Engineering, Cornell University, Ithaca, New York 14850); Bering, E.A.; Mozer, F.S. Phys. Fluids 18: No. 11, 1590-1591 (Nov 1975).

Observations have been made of electric field oscillations near the local ion gyro frequency and of an intense beam of plasma ions at the edge of an auroral arc. The observations are in good agreement with ion heating as the saturation mechanism for electrostatic ion cyclotron waves. (auth)

15538 A MEASUREMENT OF PERPENDICULAR CURRENT DENSITY IN AN AURORA. Bering, E.A.; Mozer, F.S. (Department of Physics and Space Sciences Laboratory, University of California, Berkeley, California 94720). J. Geophys. Res. 80: No. 28, 3961-3972 (1 Oct 1975).

A Nike Tomahawk sounding rocket was launched into a 400-γ auroral substorm on February 7, 1972, from Esrange, Kiruna, Sweden. The rocket instrumentation included a split Langmuir probe plasma velocity detector and a double-probe electric field detector. Above 140-km altitude the electric field deduced from the ion flow velocity measurement and the electric field measured by the double probe agree to an accuracy within the uncertainties of the two measurements. The difference between the two measurements at altitudes below 140 km provides an in situ measurement of current density and conductivity. Alternatively, if values for the conductivity are assumed, the neutral wind velocity can be deduced. The height-integrated current was 0.11 A/m flowing at an azimuth of 276°. The neutral winds were strong, exhibited substantial altitude variation in the east-west component, and were predominantly southward. (auth)

Magnetospheric Phenomena

15539 (CONF-7406113-(Absts.)) CONFERENCE ON ELECTRODYNAMICS OF SUBSTORMS AND MAGNETIC STORMS, BASYE, VIRGINIA, JUNE 11–14, 1974. Abstracts. (American Geophysical Union, Washington, D. C.; National Aeronautics and Space Administration, Washington, D. C. (USA)). 1974. 61p. American Geophysical Union, Washington, DC.

A number of short invited papers on current research and brief summary presentations are given. Abstracts for most of the invited papers are included. Topics discussed are: reconnection and other energy transfer mechanisms, substorm phases, convection, plasma flow, electric fields, low altitude plasma instabilities, and perturbations of magnetospheric particle populations. (BJG)

15540 (TRITA-EPP-75-03) ELECTRIC CURRENT STRUCTURE OF THE MAGNETOSPHERE. Alfven, H. (Kungliga Tekniska Hoegskolan, Stockholm (Sweden). Institutionen foer Plasmafysik). Apr 1975. 26p. (CONF-750461–2). Dep. NTIS (US Sales Only) $4.00.

From the nobel symposium on the physics of the hot plasma in the magnetosphere; Kiruna, Sweden (2 Apr 1975).

The most important task in cosmical electrodynamics of today is a "second approach" aiming at a replacement of pseudo-plasma theories by an empirically based description. Because in the pseudo-plasma theories the electric current is traditionally eliminated so that it does not appear explicitly, the formalism is not suited for describing phenomena associated with currents. Such phenomena are anomalous resistivity, formation of electrostatic double layers, and current disruption. Most serious is that the transfer of energy cannot be described in an adequate way. (The "field line reconnection" concept is misleading.) Magnetospheric activity is basically due to the immersion of the magnetosphere in the solar wind electric field. A simple model of the magnetospheric current system is constructed. A similar approach is used in analyzing the cosmogonic problem of angular momentum transfer, the current system in interplanetary space and in the Jovian magnetosphere, and finally to a model of double radio sources. (auth)

15541 (TRITA-EPP-75-07) MECHANISMS FOR DRIVING BIRKELAND CURRENTS. Bostroem, R. (Kungliga Tekniska Hoegskolan, Stockholm (Sweden). Institutionen foer Plasmafysik). Apr 1975. 25p. (CONF-750461–3). Dep. NTIS (US Sales Only) $3.50.

From the nobel symposium on the physics of the hot plasma in the magnetosphere; Kiruna, Sweden (2 Apr 1975).

Basic mechanisms for generating Birkeland currents in the magnetosphere, that is mechanisms for redirecting transverse currents to form field-aligned currents, are considered. Both the plasma convection and the plasma pressure can account for currents of the observed magnitude. For currents driven by the pressure there exists a constraint on the possible forms of the current distribution implying that the morning and evening systems of Birkeland current flow must balance each other at all times so that there is no net current flow in the ionosphere across certain specified contours. If the currents are driven by the plasma convection the morning and evening current systems may be independent. Geometries are suggested for plasma pressure variations and convective flow that could account for the observed distribution of Birkeland currents assuming that the currents originate on field lines within the magnetosphere extending into the plasma sheet of the magnetotail. Also considered are secondary Birkeland currents of ionospheric origin, which are currents tending to discharge ionospheric polarization electric fields. In interpreting measurements of Birkeland currents it is important to separate these secondary currents from primary currents of magnetospheric origin, which requires a determination of whether the ionospheric closure currents are dissipative or generative. (auth)

15542 ANOMALOUS DISSIPATION OF MAGNETO-HYDRODYNAMIC WAVES IN THE MAGNETOSPHERE FOR DEVELOPED ION-ACOUSTIC TURBULENCE. Liperovskii, V. A.; Khakimova, M. (Inst. of Astrophysics, Tadzhik, USSR). Izv. Vyssh. Uchebn. Zaved., Radiofiz.; 18: No. 6, 833-839(1975). (In Russian).

The damping of magneto-hydrodynamic waves in plasma with developed ion-acoustic turbulence is considered in the case when the wave frequency is much less than the collective collisional frequency and the turbulence level is not so high for the induced wave scattering by ions to be taken into account. It is shown that in contrast to the case of wave damping in pair collisions when the ion and electron contribution into the expression for the decrement compensate strongly each other. For collective collisions such a compensation is not observed and the oscillations with the frequency below $\omega_{min} = 0.25\ (W^S/nT)\ (m_e/m_i)\omega_{pe}$ attenuate strongly. For the conditions of the Earth magnetosphere, this $\omega_{min} \sim 10^{-2}\ sec^{-1}$. (auth)

15543 THREE-DIMENSIONAL POLARIZATION CHARACTERISTICS OF MAGNETIC VARIATIONS IN THE Pc 5 FREQUENCY RANGE AT CONJUGATE AREAS NEAR $L = 4$. Fukunishi, H.; Lanzerotti, L.J.; MaClennan, C.G. (Bell Laboratories, Murray Hill, New Jersey 07974). J. Geophys. Res. 80: No. 28, 3973-3984 (1 Oct 1975).

By using magnetic data measured at a network of stations extending from $L \sim 3.2$ to $L \sim 4.4$ and at a station in the conjugate area, ellipticities in the three orthogonal planes (*H-D*, *H-Z*, and *D-Z*) for the frequency range 2–5 mHz were computed continuously by the cross-spectral matrix method over 10 days with various levels of magnetic activity. The ellipticity diagrams in the *H-D* plane show that except for

the time interval during the main phase of a major magnetic storm, the sense of polarization reverses every day across local noon, with a left-hand polarization observed during local morning hours and a right-hand polarization observed during local evening hours, regardless of the level of magnetic activity. The second reversal of the sense of polarization occurs generally around ~2000 LT. The ellipticity diagrams in the *H-Z* plane show a predominantly clockwise polarization throughout the day, while the diurnal variation of the ellipticity in the *D-Z* plane tends to be confused. As to the latitude dependence of the wave phase, it is found that the *D* component oscillations are almost in phase at all latitudes, while the *H* component oscillations have advanced phase shifts at the lower-latitude stations. As to the conjugate dependence of wave phase, it is found that the *D* component oscillations are almost out of phase, while the *H* component oscillations are almost in phase at the conjugate pair stations. These polarization characteristics are discussed in terms of external driving sources coupling to the shear Alfvén waves of the local resonant field lines. Possible energy sources of Pc 5 waves are also discussed on the basis of the local time dependence of the sense of polarization. (auth)

15544 THE STORM AND POSTSTORM EVOLUTION OF ENERGETIC (35–560 keV) RADIATION BELT ELECTRON DISTRIBUTIONS. Lyons, L.R.; Williams, D.J. (Space Environment Laboratory, NOAA/ERL, Boulder, Colorado 80302). J. Geophys. Res. 80: No. 28, 3985-3994 (1 Oct 1975).

Detailed Explorer 45 equatorial observations of the storm and poststorm structure of radiation belt electrons (35–560 keV) for $1.7 \lesssim L \lesssim 5.2$ are presented. Injection during major storms results in electron pitch angle distributions and radial profiles that are greatly distorted from their quiet time equilibrium structure. Following storms the pitch angle distributions return to their prestorm shape over a period of several days. This shape is maintained as electron fluxes decay back to the quiet time levels. The equatorial radial profiles slowly return to their prestorm equilibrium structure over a period of a few weeks and then maintain that structure. (auth)

15545 DESTABILIZATION AND WAVE-INDUCED EVOLUTION OF THE MAGNETOSPHERIC PLASMA CLOUDS. Young, T.S.T. (Space Sciences Laboratory, University of California, Berkeley, California 94720). J. Geophys. Res. 80: No. 28, 3995-4003 (1 Oct 1975).

The triggering and saturation mechanisms of the electrostatic waves having frequencies near 1 1/2 times the electron gyrofrequency in the magnetosphere are studied. Also studied is the corresponding evolution of the electron distribution function caused by the wave-particle interaction. The linear instabilities supporting these waves are found to require a cold species of electrons having density between 0.1 cm^{-3} and 1 cm^{-3} and a warm species whose distribution function has a relatively weak positive slope in the velocity space perpendicular to the background magnetic field. The corresponding unstable wavelengths are short and thus result in much smaller diffusion coefficients than those derived previously. Such instabilities when triggered by an enhanced injection of ionospheric cold electrons into the warm plasma clouds can support wave amplitudes that grow to nonlinear saturation levels much greater than 10 mV/m and as large as a few hundred millivolts per meter. The majority of the observed wave activity (1–10 mV/m) can be explained as marginal instabilities maintained by a convection-induced slow increase of the cold electrons in the plasma clouds. The evolution of the waves and plasma is described in a simple physical model for different plasma parameters. (auth)

15546 THE MAGNETOSPHERIC CONTRIBUTION TO THE QUIET-TIME LOW ENERGY NUCLEON SPECTRUM IN THE VICINITY OF EARTH. Krimigis, S.M.; Kohl, J.W. (Applied Physics Laboratory, The Johns Hopkins University, Laurel, Maryland 20810); Armstrong, T.P. Geophys. Res. Lett. 2: No. 10, 457-460 (Oct 1975).

The upturn in the low energy quiet-time interplanetary nucleon spectrum has previously been described as of galactic or solar origin. Recent observations have suggested that the magnetosphere may be an important source, at least at the lowest energies. Observations obtained with the JHU/APL experiment on Explorer 47 (Imp–7) during the March 9–12, 1973 period show that the magnetosphere is the dominant contributor to the quiet time interplanetary proton population in the range $0.29 \leq Ep \leq 0.5$ MeV, and suggest that it may be an important contributor up to energies of ~1.5 MeV. The March 9–12 period is the quietest (on a time scale of hours) in a ~2.5 year interval extending from September 72 through February 1975. The quiet-time energy spectrum may be represented by a power law $E^{-(3.1 \pm 0.2)}$, the H/He ratio at $\lesssim 2$ MeV/nucleon is ~10 and the He/Z > ratio at ~1 MeV/nucleon is ~8. The ratio of anti-sunward to sunward intensities is ~2.6 and increases to ~8.55 in a frame moving with the solar wind, i.e., the maximum intensity is coming from the direction of the bow shock. The observed intensities are factors of 3 to 10 lower than those reported earlier by the Chicago group, suggesting that the interpretation of the low energy gradient measurement reported by those authors needs to be revised. It is speculated that the low energy ($\lesssim 20$ MeV) upturn in the quiet-time interplanetary proton spectrum may be related to particle emissions from planetary magnetospheres, such as that of Jupiter. (auth)

PHYSICS (ATOMIC AND MOLECULAR)

15547 MOBILITIES OF Li^+, Na^+, AND K^+ IONS IN He GAS. Takata, N. (Electrotechnical Lab., Tanashi, Japan). J. Phys., B (London); 8: No. 14, 2390-2392(1 Oct 1975).

The mobilities of Li^+, Na^+ and K^+ ions in He gas have been measured at gas temperature 38, 36 and 37°C, respectively. The obtained zero-field reduced mobilities 23.2, 22.8, and 21.4 $cm^2\ V^{-1}\ s^{-1}$ for Li^+, Na^+ and K^+ ions, respectively are similar to those reported before. (auth)

Beams and Their Reactions

Refer also to abstracts 14328, 15661, 16109, 16110, 16113, 16114, and 16117.

15548 (EFI-77(74)) POLARIZED PHOTON PRODUCTION AT THE END OF A BREMSSTRAHLUNG SPECTRUM. Avakyan, R. O.; Armaganyan, A. A.; Arutyunyan, L. G.; Danagulyan, S. S.; Darbinyan, S. M.; Mirozoyan, R. M.; Sarkisyan, R. Ts.; Taroyan, S. P.; Ehibakyan, G. M. (Erevanskij Fizicheskij Inst. (USSR)). 1974. 7p. (In Russian). INIS.

9 refs.; 1 fig.

By selective absorption of photons in single-crystal sapphire a study was made of the possibility of producing polarized photons of threshold energy. In order to accomplish this end a study was made of the absorption of photons in matter as a function of the polarization. A polarized photon beam of 4.5 GeV energy was obtained. The degree of polarization is about 15% with a 25-fold drop in the initial beam intensity. As a result of the studies it was shown that single-crystal sapphire can be used as a polarizer of high energy photons. (tr-auth)

15549 (SAND-75-0331) ANALYSIS OF TARGETS WITH NONUNIFORM COMPOSITION AS A FUNCTION OF DEPTH: ELASTIC AND INELASTIC SCATTERING. Langley, R. A. (Sandia Labs., Albuquerque, N. Mex. (USA)). Dec 1975. Contract AT(29-1)-789. 33p. Dep. NTIS $4.00.

An analytical technique to reduce yield versus energy spectra to impurity concentration versus depth is described. It applies to both elastic and inelastic reactions and calculates the depth distribution profile directly from the observed data. It uses the experimental spectrum to be analyzed, stopping cross sections and reaction cross sections to obtain the desired depth scales and the depth dependence of the target composition. A computer code, NUCREA, has been developed to perform such analysis. A description of NUCREA, a user's guide, a complete listing and a typical output for the code are contained in the report. An example showing the analysis of experimental data is also presented.

15550 FIELD DESORPTION ION SOURCE AND METHOD OF FABRICATION. Heil, H. W. US Patent 3,911,311. 7 Oct 1975. Priority date 3 Jul 1973, German, Federal Republic of (F. R. Germany). 6p.

A gas permeable electrode is arranged to project into an evacuated space with the vacuum side of the electrode coated with a gas impervious material except at the tip of the electrode. The other end of the electrode is exposed to an ionizable gas that is caused to diffuse through the electrode and be ionized at the tip of the electrode on the high vacuum side by an electrical field created between the gas permeable electrode and an extraction electrode in the high vacuum space. (auth)

15551 HIGH BRIGHTNESS ION SOURCE. Dreyfus, R. W.; Hodgson, R. T. (to International Business Machines Corp.). US Patent 3,914,655. 21 Oct 1975. Filed date 28 Jun 1973. 4p.

A high brightness ion beam is obtainable by using lasers to excite atoms or molecules from the ground state to an ionized state in increments, rather than in one step. The spectroscopic resonances of the atom or molecule are used so that relatively long wavelength, low power lasers can be used to obtain such ion beam. (auth)

15552 DEPENDENCE OF SELF-FOCUSING OF A HIGH-INTENSITY PULSED ELECTRON BEAM ON GASEOUS MEDIA AS STUDIED BY DEPTH-DOSE DISTRIBUTIONS. III. Hydrocarbons and Halogenomethanes. Arai, H.; Hotta, H. (Japan Atomic Energy Research Inst., Takasaki). Radiat. Res.; 64: No. 3, 407-415(Dec 1975).

The self-focusing of a pulsed electron beam in organic gaseous media was investigated as a function of pressure. The relative total ionization cross section of gases, obtained from the present study, is correlated with molar static electron polarization. Below 1 torr the pinch initially enhances and then declines with increasing pressure. At pressures greater than 10 torr, the beam exhibits the self-focusing again. The self-focusing between 10 and 40 torr is successively stronger in gases interacting more strongly with secondary electrons, i.e., CH_4 less than C_2H_6 less than C_3H_8 less than C_4H_{10} less than C_5H_{12}, C_2H_6 less than C_2H_4 less than C_2H_2, and CH_4 less than CH_3F less than $CHClF_2$ less than CCl_2F_2. Multiple scattering of the primary beam becomes effective above 200 torr. (auth)

15553 THEORY OF THE STABILITY OF RELATIVISTIC BEAMS OF ELECTRONS AND THE PROBLEM OF CRITICAL CURRENTS. Zeljazkov, I. God. Sofii. Univ., Fiz. Fak.; 65: 81-104(1973). (In Bulgarian).

A theoretical examination is made of the instabilities causing a decrease in the quantity of the current of electron beams. A formula for the boundary currents of noncompensated cylindrical relativistic electron beams is deduced. It is shown that when the electron spatial charge is compensated, the current of the beams can increase by $(E/mc^2)^2$ times with respect to the noncompensated beam current (E—the energy of the electrons of the beam, m—the mass of the electron at rest). A comparison is made between the theoretical conclusions and the data from experiments with nonrelativistic electron beams and it is shown that the discrepancy between theory and experience is within reasonable limits. (auth)

15554 LIMITATION OF THE ION CHARGE STATE IN DUOPLASMATRON-TYPE MULTIPLY-CHARGED ION SOURCES. Winter, H.; Wolf, B. H. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (F. R. Germany)). Nucl. Instrum. Methods; 127: No. 3, 445-457(15 Aug 1975).

Using a simplified charge carrier balance model developed for the Duoplasmatron discharge, it is shown that the energy of the majority of the ionizing electrons cannot, in principle, exceed a certain limit. Thus, for each element used as an operating substance, a charge limit can be given which, for all practical purposes, cannot be exceeded in the production of multiply-charged ions in a C. W.-Duoplasmatron ion source. A discussion of the interaction mechanisms between the primary electrons and the plasma particles shows that this electron energy limit can be reached even when it is higher than the discharge voltage would indicate. These concepts are confirmed for several kinds of ions by experiments: a survey is given of the highest charge states attainable for the elements which can be handled with a C. W. Duoplasmatron multiply-charged ion source. (NL)

15555 A C. W.-OPERATED DUOPLASMATRON MULTIPLY-CHARGED ION SOURCE. Krupp, H.; Winter, H. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (F. R. Germany)). Nucl. Instrum. Methods; 127: No. 3, 459-469(15 Aug 1975).

Parametric studies were conducted with a Duoplasmatron multiply-charged ion source, capable of continuous operation with discharge currents of more than 20 A, and further capable of continuously varying the length of the anodic discharge space during operation. Insights were obtained regarding characteristic operation states for the production of intensive beams of multiply-charged ions, and various conclusions concerning reliable operation and practical design of Duoplasmatron multiply-charged ion sources have been formulated. (NL)

15556 PHOTOEXCITATION AND OPTICAL PUMPING IN A BARIUM ATOMIC BEAM. Aubert, D.; Baldy, A.; Baulaigue, P.; Chantrel, H. (Aix-Marseille-1 Univ., 13—Marseille (France)). Rev. Phys. Appl.; 10: No. 4, 187-194(Jul 1975). (In French)

An apparatus allowing the photoexcitation of barium atomic beam over its whole surface is described. This photoexcitation is achieved by another barium spectrum emitted up stream of the beam by a cathodic out-flow produced at the exit oven. The fluorescence spectrum is studied in detail as well as the influence of different parameters, such as oven temperature, current intensity of the outflow, and excitation depth. A calculation shows how to determine Einstein coefficient, oscillator strengths and atomic lifetimes from our experimental measurements. (FR)

15557 ATOMIC EJECTION IN THE SINGLE CRYSTAL SPUTTERING OF NICKEL WITH 40—600 eV ARGON IONS. Leung, Y. K. Corvallis, OR; Oregon State Univ. (1975). 69p. University Microfilms Order No. 75-26,061.

Thesis (Ph. D.).

A three-stage, differentially pumped ion accelerator is used to produce low energy argon ions, which in turn, are used to bombard the surfaces of plane nickel single crystals. Nickel atoms ejected from the crystals are counted using the radioactive tracing method. From the analysis of the angular distributions of ejected atoms, the study of low energy single crystal sputtering is made possible. (Diss. Abstr. Int., B)

15558 ELECTRON AND ION BEAM SCIENCE AND TECHNOLOGY. Sixth International Conference on Electron and Ion Beam Science and Technology, Held in San Francisco, California, May 12–17, 1974. Bakish, R. (ed.). Princeton, NJ; Electrochemical Society, Inc. (1974). 606p. (CONF-740515--).

Topics covered include: x-ray lithography; electron photoresists; electron beam pattern generation; analytical techniques in electron and ion beam technology; electron beam welding, machining, and evaporation; and relativistic electron beams. Of the 43 papers in the conference, abstracts of 8 appear in this issue of NSA and one has appeared previously (30: 05805) in NSA. (GHT)

For abstracts of individual papers see: 14250, 14965, 15394, 15559–15561, 16113, and 16114.

15559 NEPTUNE-C PULSED ELECTRON BEAM. Wenstrup, R. S. (Ion Physics Corp., Burlington, MA). pp 469-481 of Electron and Ion Beam Science and Technology. Bakish, R. (ed.). Princeton, NJ; Electrochemical Society, Inc. (1974).

From 6th international conference on electron and ion beam science and technology; San Francisco, California, USA (12 May 1974). See CONF-740515-.

The Ion Physics Corporation Neptune-C Low Impedance Pulsed Electron Beam Generator, capable of several hundred kiloampere currents with mean energies from 100 to 500 keV in a power pulsewidth of approximately 70 nanoseconds, is described. Beam energies as high as 5 kilojoules in the anode plane and 2.3 kilojoules at the end of a solid guide cone in a drift chamber are possible. The pulse generator and diode characteristics for electron beam generation are discussed. Beam uniformity over 5 and 18 cm^2 target areas were measured with a high resolution graphite calorimeter; measurements show the beam fluence is uniform over the central 0.8 inches of a 1.0 inch diameter beam. Maximum fluences delivered to a target at the end of a solid guide cone are 30 cal/cm^2 over 18 cm^2, 90 cal/cm^2 over 5 cm^2, and 150 cal/cm^2 over 2.85 cm^2. Shot-to-shot reproducibility at beam fluences from 26 to 68 cal/cm^2 is better than +-7 percent. The energy deposition in a graphite target has been measured in a transmitted fluence experiment; the measured depth-dose profile agrees well with the calculated profile. (auth)

15560 DESIGN OF LARGE AREA ELECTRON BEAM GUNS. Amboss, K. (Hughes Research Labs., Malibu, CA). pp 497-517 of Electron and Ion Beam Science and Technology. Bakish, R. (ed.). Princeton, NJ; Electrochemical Society, Inc. (1974).

From 6th international conference on electron and ion beam science and technology; San Francisco, California, USA (12 May 1974). See CONF-740515-.

The factors which enter into the design of large area high voltage electron beam guns in which the beam emerges from vacuum into a gaseous environment through a thin foil window are reviewed. The following restraints are considered: The type of cathode which can be used, the restrictions imposed by voltage breakdown, the need for uniform current density distribution, the maintenance of uniformity during modulation, and the restrictions imposed by the foil window. The design of a 5-cm wide by 125-cm long gun for cw operation is described. (auth)

15561 LOW PERVEANCE ION BEAM EXTRACTION FROM AN ELECTRON BOMBARDMENT DISCHARGE. Seliger, R. L.; Ward, J. W. (Hughes Research Labs., Malibu, CA). pp 518-524 of Electron and Ion Beam Science and Technology. Bakish, R. (ed.). Princeton, NJ; Electrochemical Society, Inc. (1974).

From 6th international conference on electron and ion beam science and technology; San Francisco, California, USA (12 May 1974). See CONF-740515-.

Ion beams extracted from an electron bombardment (Penning) discharge by low perveance, single aperture Pierce electrode configuration, are compared with the beam properties predicted by a space charge computer program. For a 1 mm diameter source aperture, and an electron perveance of 1 x 10^{-8} AV/sup $-3/2$/, the measured and computed results are in good agreement. When this configuration was scaled up to have a 4 mm diam source aperture the extracted current was as much as 40 percent higher than predicted by the calculated electron perveance of 1 x 10^{-8} AV/sup $-3/2$/. In the case of an electrode configuration with a calculated electron perveance of 3.5 x 10^{-8} A/V/sup $-3/2$/, that was also scaled to a 4 mm diameter source aperture, the extracted current was also 40 percent higher than predicted. In the latter case at 70 kV a maximum beam current of 4.3 mA (or argon) could be extracted with 0.8 A of discharge current. Plasma sheath instabilities occurred at currents above approximately 2 times the calculated perveance. (auth)

15562 INFLUENCE OF CHEMICALLY ACTIVE GAS ON THE LIGHT EMISSION OF METALLIC TARGETS BOMBARDED BY POSITIVE IONS. Meriaux, J. P.; Goutte, R.; Guillaud, C. (Institut National des Sciences Appliquees (INSA), 69 – Villeurbanne (France). Lab. d'Optique Corpusculaire et d'Electroacoustique). Appl. Phys.; 7: No. 4, 313-320(Aug 1975).

9 figs.; 1 tab.; 31 refs.

The introduction of oxygen in the vicinity of a metallic target surface, bombarded with positive argon ions of twenty kiloelectronvolts, increases the number of sputtered atoms in the excited state. This phenomenon of exaltation, very sensitive in the case of nickel and aluminium, is much less marked in the case of molybdenum. Moreover, the emission of excited particles coming from the beam's ions is not modified. A quantum-mechanical model of a kinectic emission process, which permits the interpretation of the clean metallic target's emission phenomena, seems insufficient to explain all of the results obtained in the presence of oxygen. In this last case, one can therefore use a thermodynamic model in which excited metallic particles can be formed directly by chemical surface reactions of neutralization or reduction. (DE)

15563 EFFICIENT ATOMIC BEAM OVEN FOR USE IN LOW ENERGY ELECTRON SCATTERING EXPERIMENTS. Cvejanovic, D.; Adams, A.; Imhof, R. E.; King, G. C. (Univ. of Manchester, Eng.). J. Phys., E (London); 8: No. 10, 809-810 (Oct 1975).

An atomic or molecular beam oven is described which is suitable for use in electron scattering experiments. The main feature of the oven is the highly efficient use of target material. (auth)

15564 DETERMINATION OF ENERGY LOSSES OF NITROGEN IONS FROM THE BACKSCATTERING SPECTRA. Neshev, F. G.; Puzanov, A. A.; Shyshkin, K. S.; Sirotinin, E. I.; Tulinov, A. F.; Ved'manov, G. D. (Moscow State Univ.). Radiat. Eff.; 25: No. 4, 271-273(Aug 1975).

A method proposed earlier to determine the energy losses from the spectrum of particles scattered by a thick target is used to find the energy losses of N ions in Ti, Ge, Ni, Ag, Au and W in the energy region $1.0 \leq E_N \leq 7.4$ MeV. (auth)

15565 SORBAS: AN APPARATUS FOR INVESTIGATING ION SCATTERING FROM SURFACES AT ENERGIES 100–200 ev. Taglauer, E.; Melchior, W.; Schuster, F.; Heiland, W. (Max-Planck-Institut fuer Plasmaphysik, Garching, Ger.). J. Phys., E (London); 8: No. 9, 768-772(Sep 1975). (In German).

An UHV apparatus is described which allows energy analysis of low energy rare gas ions backscattered from surfaces in the energy range from 100 to 2000 eV and in a large range of scattering angles. Surface composition is measured by ion scattering and Auger electron spectroscopy. Surface structure of monocrystalline samples is evaluated by LEED. Examples of surface composition analysis and ion impact desorption are given. (auth)

15566 COMPUTATIONAL STUDY OF THE FIRST STAGE OF HYPERSONIC ION BEAM NEUTRALIZATION: THE CROSS NEUTRALIZATION STAGE. Pomot, C.; Dolique, J.M. (Laboratoire de Physique des Plasmas, Equipe de Recherche Associée au Centre National de la Recherche Scientifique, Université Scientifique et Médicale, Grenoble I, France). Phys. Fluids 18: No. 12, 1698-1703 (Dec 1975).

A study is made of the first stage of evolution of a hypersonic ion beam in which thermoelectrons are emitted by a heated grid, known as the neutralizer. Downstream from the neutralizer there appears successively a sheath, a range of periodic and quasi-stationary electric field and a front where the electric field oscillates with the plasma frequency. The sheath is self-regulated. Some electrons are trapped in the periodic and stationary electric field. The characteristics of the periodic, quasi-stationary range correspond to those of both an experimental study and one-dimensional time-independent macroscopic theory. This quasi-stationary regime builds up in a time smaller than ω_{pe}^{-1} and is studied for a few periods $\omega_{p_e}^{-1}$. The subsequent evolution of this state of nonequilibrium is not investigated. The experimental study has shown that, as for the neutralization of a subsonic ion beam, it leads to a field-free, homogeneous medium: a "synthesized plasma." The importance of the first stage described herein, which may be called the gross neutralization stage, is due to the properties of mean neutrality in the current and in the charge insured by the regulating sheath, properties which will be preserved downstream. (auth)

15567 SURFACE ELECTRIC FIELD MODEL FOR THE BEAM-TILTED-FOIL INTERACTION. Lombardi, M. (Laboratoire de Spectrométrie Physique, Université Scientifique et Médicale, 38041 Grenoble-Cedex, France). Phys. Rev. Lett. 35: No. 17, 1172-1175 (27 Oct 1975).

It is shown that the experiments on the polarization of the light emitted after beam-tilted-foil interaction are compatible with a surface electric field model. (auth)

15568 *L*-SHELL X-RAY PRODUCTION CROSS SECTIONS FOR LIGHT IONS ON Sm, Yb, AND Pb. Gray, T.J.; Light, G.M.; Gardner, R.K.; McDaniel, F.D. (Regional Nuclear Physics Laboratory, Department of Physics, North Texas State University, Denton, Texas 76203). Phys. Rev. A 12: No. 6, 2393-2398 (Dec 1975).

L-shell x-ray production cross sections for the Ll, $L\alpha_{1,2}$, $L\gamma_1$, and $L\gamma_{2,3,(6)}$ have been measured for ^1H, ^4He, and ^7Li on Yb and Pb and for ^4He and ^7Li on Sm. The energy ranges for the incident-ion species were 0.3 to 2.4 MeV/amu for ^1H, 0.15 to 4.4 MeV/amu for ^4He, and 0.9 to 3.0 MeV/amu for ^7Li. Comparisons of the $L\alpha_{1,2}$, $L\gamma_1$, and $L\gamma_{2,3,(6)}$ x-ray production cross-section data have been made to the predictions of the plane-wave Born approximation (PWBA) and the PWBA with corrections for Coulomb deflection and/or binding-energy effects. The comparisons show that for the individual x-ray production cross sections, there are problems associated with the binding-energy correction calculations for the $L\gamma_1$ and $L\gamma_{2,3}$ x-ray data. Furthermore, measurements of the ratio of $L\alpha_{1,2}$ to $L\gamma_{2,3}$ x-ray intensities do not support the use of an increased effective binding energy in the PWBA formulation. (auth)

15569 DETECTION OF HYDROGEN ATOM BEAMS BY STIMULATED SURFACE IONIZATION. Gordon, R.J.; Hsu, D.S.Y.; Lee, Y.T.; Herschbach, D.R. (Department of Chemistry, Harvard University, Cambridge, Massachusetts 02138). J. Chem. Phys. 63: No. 11, 5056-5058 (1 Dec 1975).

The flux of a hydrogen beam has been measured by ionization of an alkali metal coating on a tungsten filament. It is suggested that this method is generally applicable to extending the range of surface ionization detectors. (AIP)

15570 STIMULATED SURFACE IONIZATION: A NEW EFFECT. Helbing, R.K.B.; Hsieh, Y.F.; Pol, V. (University of Windsor, Physics Department, Windsor, Ontario, Canada N9B 3P4). J. Chem. Phys. 63: No. 11, 5058-5060 (1 Dec 1975).

Stimulated surface ionization of alkali atoms adsorbed on a tungsten surface by a molecular beam is reported. The effect is demonstrated for sodium and rubidium beams ionizing adsorbed potassium. (AIP)

15571 REACTIONS OF MODULATED MOLECULAR BEAMS WITH PYROLYTIC GRAPHITE. III. HYDROGEN. Balooch, M.; Olander, D.R. (Materials Research Division, Lawrence Berkeley Laboratory and the Department of Nuclear Engineering, University of California, Berkeley, California 94720). J. Chem. Phys. 63: No. 11, 4772-4786 (1 Dec 1975).

The reaction of hydrogen and pyrolytic graphite was studied by modulated molecular beam–mass spectrometric methods. Because molecular hydrogen does not react with graphite (within the detection limits of the technique), an atomic hydrogen reactant beam was generated by thermal dissociation of H_2 in an effusion oven. For surface temperatures up to 800 °K, methane was the sole product. Acetylene was observed at temperatures above 1000 °K. Between 800 and 1000 °K, no carbon gasification occured; the surface acted only to recombine H atoms to form H_2. The data were analyzed in terms of a model in which methane is formed by sequential addition of H atoms to CH_n (n=0,1,2,3) and acetylene is formed by surface combination of two CH groups. The agreement between the model and the molecular beam data is very good. The model also predicts previous high pressure (1 atm H_2) carbon gasification rates determined in conventional kinetic experiments. (auth)

15572 ROTATIONALLY INELASTIC DIFFRACTION OF MOLECULAR BEAMS: H_2, D_2, HD FROM (001) MgO. Rowe, R.G.; Ehrlich, G. (Coordinated Science Laboratory and Department of Metallurgy, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801). J. Chem. Phys. 63: No. 11, 4648-4665 (1 Dec 1975).

In the coherent scattering of molecules from a crystal surface, energy of molecular rotation can be transferred to translational motion. This interchange has been studied for thermal beams of H_2, D_2, and HD diffracted from (001) surfaces of MgO prepared by cleavage in an ultrahigh vacuum. Strong new diffraction peaks are identified for in-plane scattering, beyond those predicted for elastic interactions. The location of these peaks is in agreement with calculations based on the assumption that phonons are not excited during the collision with the lattice. In the experiments, only those rotational transitions are detected for which there are extrema in the variation of the scattering angle with the wavenumber of the incident molecules. Scattering at these critical angles is analyzed and it is shown that for beams formed by effusion, these extrema lead to sharply peaked scattering maxima, which facilitate detection of rotational–translational interchanges. The efficiency of rotational transitions is found to be high, comparable to elastic scattering, and to depend strongly upon the angle between the incident beam and the scattering surface. (auth)

15573 QUASICLASSICAL TRAJECTORY CALCULATIONS OF He–LiF (001) DIFFRACTION SCATTERING. Ray, C.J.; Bowman, J.M. (Department of Chemistry, Illinois Institute of Technology, Chicago, Illinois 60616). J. Chem. Phys. 63: No. 12, 5231-5234 (15 Dec 1975).

A quasiclassical trajectory method for describing elastic diffraction scattering of an atom from a crystal surface is presented and applied to the He–LiF (001) system. The results for a 20 meV, oriented ^4He beam are compared with the recently reported quantum ones of Wolken and the semiclassical ones of Doll. The dependence of the specular scattering intensity on the initial beam orientation is calculated and compared with the quantum results of Wolken. It is concluded that the quasiclassical results are semiquantitatively accurate, only slightly less accurate than the uniform semiclassical results (without inclusion of complex-valued trajectories), but more accurate than the classical and primitive semiclassical results. (auth)

15574 SOME ASPECTS OF HIGH-CURRENT RELATIVISTIC ELECTRON-BEAM GENERATION. Forster, D.W.; Goodman, M.J.; Herbert, H.G. (Atomic Weapons Research Establishment, Aldermaston, Berkshire, England). J. Vac. Sci. Technol. 12: No. 6, 1177-1182 (Nov 1975).

Diode characteristics in two electron-beam generators, IT and ACE, are examined, with particular reference to the role of prepulse conditions. The advantages and limitations of field-enhanced edge emitters are discussed. In both low- and high-current-density applications, a stable impedance–time history is shown to be associated with a band of prepulse voltage which is a function of both its time variation and driving impedance. Above this band rapid impedance collapse occurs, and below it long current switch-on times are experienced. This behavior is postulated to be dependent upon cathode plasma formation and growth during prepulse and early main pulse phases. The results of a preliminary investigation into the controlled use of prepulse for high-current-density beam production from field-enhanced edges are examined. The characteristics of hollow cylindrical cathodes operating in pinched mode are shown to depend on prepulse conditions. In particular, the transfer of finite energy (of order tens of millijoules) to the diode during the prepulse phase is shown to be desirable for rapid establishment of the required diode impedance in the main pulse phase. (auth)

15575 OWL II PULSED-ELECTRON-BEAM GENERATOR. Frazier, G.B. (Physics International Company, San Leandro, California 94577). J. Vac. Sci. Technol. 12: No. 6, 1183-1187 (Nov 1975).

OWL is a water-dielectric line-type pulse generator capable of producing ~100-nsec electron beams with total energies of as much as 150 kJ. In its present form, OWL II consists of an oil-immersed, 1/3-MJ Marx generator charging a 3.9-Ω coaxial pulse-forming line which is series switched into either a two- or three-stage impedance transformer. The output impedance is 1.9 or 1.1 Ω, depending upon which transformer is used, and nominal beam outputs in the two cases are 1.3 MV at 0.8 MA and 0.9 MV at 1.2 MA, respectively. The pulse width can be selected at either 60 or 120 nsec (FWHM of power) by interchanging two available pulse lines. Shot-to-shot reproducibility in output of ±2% with a mean electron energy ~1.0 MeV is obtained with the 1.9-Ω final transformer. A triggered multichannel water switch minimizes the risetime of pulses injected into the transformer section. (auth)

15576 GENERATION AND EXTRACTION OF MICROSECOND INTENSE RELATIVISTIC ELECTRON BEAMS. Schneider, R.; Stallings, C.; Cummings, D. (Physics International Company, San Leandro, California 94577). J. Vac. Sci. Technol. 12: No. 6, 1191-1193 (Nov 1975).

The Physics International Pulserad 1140 has been modified so that a pulse length of 1.7 μsec can be obtained with a beam energy of 50 kJ. This modification involves substituting a pulse-forming network for the conventional Blumlein. This long-pulse generator has been used to study diode behavior on 1-μsec time scales. The dependence of impedance on voltage and anode–cathode spacing is discussed here. A semiempirical model has been developed. The diode time history and closure velocity are discussed in terms of this model. (auth)

15577 SECONDARY-EMISSION ELECTRON GUN FOR HIGH PRESSURE MOLECULAR LASERS. Pigache, D.; Fournier, G. (Office National d'Etudes, et de Recherches, Aerospatiales, Chatillon, France). J. Vac. Sci. Technol. 12: No. 6, 1197-1199 (Nov 1975).

A new type of high voltage, large area electron gun is described. Ions are generated in a low pressure ion source, extracted by a grid, and accelerated by a −130-kV continuously biased electrode. By secondary emission, these ions produce electrons which are accelerated toward the grid. They go through the ion source and an electron window (15×5 cm). Electron-beam density profiles display a good uniformity. The current density, limited only by the available power for the discharge, reaches presently 1 mA/cm². The advantages of this gun over others are moderate vacuum requirements and capability for both low current cw and high current pulsed beams with easy control at ground potential and small energy requirement. (auth)

15578 PROGRESS IN INTENSE PULSED ION SOURCES. Humphries, S. Jr. (Cornell University, Ithaca, New York 14853). J. Vac. Sci. Technol. 12: No. 6, 1204-1207 (Nov 1975).

Progress in the development of intense, pulsed ion sources is described. The major impediment, electron breakdown, can be solved by magnetic insulation of the accelerating gap or reflex geometries. Both magnetic insulation and the reflex triode have been used successfully at Cornell to efficiently generate multikiloampere ion fluxes. Scaling of these devices to the range of parameters attained by pulsed electron

machings (MA in the MV range) appears feasible. Such ion beams may have applications in plasma heating, ion ring production, thermonuclear pellet compression, and other areas of physical research. (auth)

15579 STUDY OF A FIELD-IONIZATION SOURCE FOR MICROPROBE APPLICATIONS. Orloff, J.H.; Swanson, L.W. (The Oregon Graduate Center, Beaverton, Oregon 97005). J. Vac. Sci. Technol. 12: No. 6, 1209-1213 (Nov 1975).

Operating parameters for a field-ionization source have been measured. Sensitivities of 5×10^{-5} A sr^{-1} $Torr^{-1}$ were found at 77 K. Angular distributions are uniform near $\theta=0°$ and show the beam to be confined to $\pm20°$. The beam signal-to-noise ratio was found to increase with increasing current. Calculations based on parameters of lenses in use indicate a resolution of 0.1 μm at $\gtrsim 10^{-10}$ A is possible. (auth)

15580 A CONTRIBUTION TO EXPLAIN THE DEEP PENETRATION OF HIGH-POWER-DENSITY ELECTRON BEAMS IN METALS. Schebesta, W. (Institut für Industrielle Elektronik, Technische Hochschule Wien, Gusshausstrasse 27, A-1040 Vienna, Austria). J. Vac. Sci. Technol. 12: No. 6, 1218-1220 (Nov 1975).

Contrary to the widespread opinion that an electron beam evaporates the material when used as a tool, observations are described which can be explained more satisfactorily with an explosion mechanism. When the electron beam penetrates deeply into the material, regular oscillations of the target current are observed. The main features of these oscillations for various materials are described. These oscillations are explained by intermittent thermionic emissivity and explosions of the energy transfer zone. (auth)

15581 OPTIMIZATION OF AN ELECTRON-BOMBARDMENT ION SOURCE FOR ION MACHINING APPLICATIONS. Reader, P.D. (Ion Tech, Incorporated, Fort Collins, Colorado 80522); Kaufman, H.R. J. Vac. Sci. Technol. 12: No. 6, 1344-1347 (Nov 1975).

A new 10-cm-diameter ion source has been designed specifically for ion machining applications. This source employs technology and experience from the development of ion engines for electron space propulsion and generates a highly uniform beam of 500-eV Ar^+ at current densities exceeding 2 mA/cm². (auth)

15582 PENNING SOURCE FOR ION IMPLANTATION. Flemming, J.P. (Western Electric Engineering Research Center, P.O. Box 900, Princeton, New Jersey 08540). J. Vac. Sci. Technol. 12: No. 6, 1369-1372 (Nov 1975).

A cold-cathode Penning-type ion source with axial extraction has been developed to provide the milliampere ion currents needed for high volume, high throughput ion implantation. For solid feed material, the source is fitted with an oven that is concentric with the anode. The oven windings heat the anode to prevent condensation of feed vapor in the source. The ion beam is extracted through a three-element electrode assembly which provides lens action. The optical effect of space-charge forces completes beam formation. The output consists of up to 12 mA ion current in the form of a beam that is parallel to better than 10 mR and of diameter less than 2.5 cm. The beam contains 15% boron, 30% phosphorus, 50% arsenic when the source is run on BF_3, 10% PH_3, or solid arsenic. The source allows analyzed currents in the 1–3-mA range to be produced for periods of about 40 h. (auth)

15583 ION MILLING (ION-BEAM ETCHING), 1954–1975: A BIBLIOGRAPHY. Hawkins, D.T. (Bell Telephone Laboratories, Murray Hill, New Jersey 07974). J. Vac. Sci. Technol. 12: No. 6, 1389-1398 (Nov 1975).

The ion milling process is briefly described as an introduction to the extensive bibliography presented on this process and its varied applications. (AIP) (auth)

15584 MOLECULAR BEAM STUDY OF OXYGEN AND C_2 HYDROCARBON CHEMISORPTION AND REACTIONS ON Pt(111). Palmer, R.L. (IRT Corporation, P.O. Box 80817, San Diego, California 92138). J. Vac. Sci. Technol. 12: No. 6, 1403-1409 (Nov 1975).

The chemisorption and reactions of oxygen and the C_2 hydrocarbons (acetylene, ethylene, and ethane) on epitaxially grown Pt(111) crystals have been studied using modulated molecular beam techniques. The sticking coefficient of ethylene is observed to be about half that for acetylene, which is near unity on oxygen covered Pt(111) in the temperature range 550–1000 K. For ethane, $S<0.05$ under these same conditions. The results of this study are in agreement with other studies that show that the adsorption of the C_2 hydrocarbons on platinum at elevated temperatures results in a surface acetylenic species. The first step in the oxidation process appears to be the removal of hydrogen atoms from this surface acetylene, either by molecular desorption or by reaction with surface oxygen atoms. Surface carbon then reacts with surface oxygen to form CO which either desorbs or reacts further to form CO_2. At high oxygen pressures, the reaction rate is apparently limited by the mobility of surface oxygen atoms which have an activation barrier to diffusion on Pt(111) of about 16 kcal/mole. Some implications of this high surface mobility with regard to the gas–surface oxygen equilibrium are discussed. The observance here of two distinct components in the angular desorption distributions of CO and CO_2 is discussed in terms of finer details of the reaction mechanism. (auth)

Atomic and Molecular Properties

Refer also to abstracts 14340, 15651, 15668, 15969, 15988, 16038, and 16105.

15585 (AEC-tr-7295, pp 165-171) CALCULATION OF THE POTENTIAL-ENERGY SURFACES OF THREE HYDROGEN ATOMS. Shchekatolina, S. A.; Yakub, E. S. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli i Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

Potential-energy surfaces for three hydrogen atoms were calculated within the limits of the atomic orbital method, which corresponds to the first order of excitation theory or the Gaitler-London method. All three-center, exchange, and overlap integrals have been considered. A semiempirical method for calculating the ground-state potential-energy surface of three hydrogen atoms has been employed. (3 figs, 8 refs) (GHT)

15586 (ITP-75-62R) DOUBLETS OF ALPHA-OXYGEN. II. Experiment. Gaididei, Yu. B.; Loktev, V. M.; Prikhot'ko, A. F.; Shanskii, L. I. (AN Ukraninskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1975. 24p. (In Russian). Dep. NTIS (US Sales Only) $3.50.

The experimental results of the investigations of biexciton absorption alpha-O_2 performed at the temperature near 1°K are presented. The interpretation of a doublet structure of the absorption observed is suggested using the theory developed in I. The effect of resonance interactions in the formation processes of bimolecular electron-vibrational series and the role of the collective excited states of a crystal are discussed.

15587 (LBL-3858) HYPERFINE QUENCHING OF THE 2^3P_0 STATE IN HELIUMLIKE IONS. Mohr, P. J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 19 Nov 1975. Contract W-7405-Eng-48. 7p. (CONF-750975-12). Dep. NTIS $4.50.

From 4th international conference on beam-foil spectroscopy; Gatlinburg, Tennessee, USA (15 Sep 1975).

An estimate is presented of the lifetime of the 2^3P_0 state for odd-Z heliumlike ions in the range Z equals 9 to 29. An approximation scheme is employed which utilizes the fact that both Z^{-1} and $(Z\ alpha)^2$ are small parameters for the range of Z under consideration. 1 fig, 2 tables, 14 refs. (GHT)

15588 (ORO-3346-173, pp 25-29) X-RAY AND ELECTRON SPECTROSCOPY WITH RADIOACTIVE SOURCES. 31 Oct 1975.

In nuclear and x-ray spectroscopy with radioactive sources. Eleventh annual progress report, February 1, 1975–January 31, 1976. (Georgia Inst. of Tech., Atlanta (USA). School of Chemistry).

Preliminary work on L_1-subshell x-ray fluorescence and Coster-Kronig yields, and measurements of mean L-fluorescence yields from double vacancy states in indium is reported. (SDF)

15589 FLOATING NUCLEI APPROXIMATION AND ITS POSSIBLE USE IN THE CONFORMATIONAL ANALYSIS. Golebiewski, A.; Nalewajski, R. (Jagellonian Univ., Krakow). Acta Phys. Pol., Ser. A48: No. 3, 423-433(Sep 1975).

A procedure for calculating the equilibrium positions of protons in a molecule, based on what is called the floating nuclei approximation, is presented. The Hellmann-Feynman forces vanish in this approximation, the wave-function forces being disregarded. Molecular geometry is found iteratively. Illustrative examples are given for the H_2, HF, H_2O molecules. (auth)

15590 HYPERFINE STRUCTURE IN INTERMEDIATE COUPLING OF THE FIRST EXCITED ELECTRON CONFIGURATION $6p^27s$ OF ^{209}Bi ($I = 9/2$). Dembczynski, J.; Frackowiak, M. (Technical Univ., Poznan, Poland). Acta Phys. Pol., Ser. A48: No. 1, 139-155(Jul 1975).

The hyperfine structure of the $6p^3\ ^2D^0_{\frac{5}{2}}$ and $^2D^0_{\frac{3}{2}}$ and $6p^27s^4P_{\frac{5}{2}}$, $^4P_{\frac{3}{2}}$, $^2P^0_{\frac{3}{2}}$ and $^2P^0_{\frac{1}{2}}$ levels of Bi have been measured in the $\lambda\lambda$ = 4722 Å, 4122 Å, 3596 Å, and 2696 Å with a PGS-2 plane grating spectrograph. (auth)

15591 WAVE FUNCTIONS, SLATER INTERGRALS F^k, AND ζ PARAMETER FOR Pr^{3+}. Baster, M. (Pedagogical Coll., Krakow); Bialas-Zabawa, A. Acta Phys. Pol., Ser. A48: No. 1, 135-137(Jul 1975).

The radial parts of the atomic orbitals were obtained from the solution of the Hartree-Fock-Slater equations using the method of Herman and Skillman in the analytic version. The values obtained in this way were used to calculate the Slater integrals F^k

and the ζ parameter. Finally the obtained results were compared with those gotten by other authors.

15592 HYPERFINE STRUCTURE ANALYSIS OF THE GROUND CONFIGURATIONS $5d^86s^2$ AND $5d^96s$ OF THE Pt-I-SPECTRUM. Mueller, G.; Winkler, R. (Technische Univ. Berlin (F. R. Germany). Optisches Inst.). Z. Phys., A; 273: No. 4, 313-320(1975). (In German).

3 figs.; 6 tabs.; 27 refs.

The hyperfine structure of the ground configuration $5d^86s^2$ and $5d^96s$ of the stable platinum isotopes 194, 195, 196, 198 was analyzed. For the isotope 195 a complete set of the magnetic splitting constants A is given. The A constants of the levels $5d^86s^2$ $^3P_1$, and $^1D_2$ were determined for the first time. From these data the electronic splitting constants a_{6s} = 1,010(10) mK, $a_{d_{\frac{3}{2}}}$ = 57(6), and $a_{d_{\frac{5}{2}}}$ = 27(2) mK could be evaluated. The effect of core polarization is discussed and a field $\chi_{cp} = -5.6(1.0)$ a.u. per 5d-electron spin is found. The isotopic shift is also determined, and for the mean quadratic nuclear charge radius the value $\beta\delta(r^2) = 0.095(10)$ fm^2 is derived. (DE)

15593 PHOTOIONISATION OF ATOMS AND MOELLER OPERATORS. Combe, P. (Aix-Marseille-2 Univ., 13 – Marseille (France). Centre Universitaire de Luminy; Centre National de la Recherche Scientifique, 13 – Marseille (France). Centre de Physique Theorique); Mourre, E.; Richard, J. L. (Centre National de la Recherche Scientifique, 13 – Marseille (France). Centre de Physique Theorique). Commun. Math. Phys.; 43: No. 2, 161-170(Jul 1975).

14 refs.

The motion of an hydrogenoid atom in a laser field is usually given by the time-dependent Hamiltonian $H(t) = [p - A(t)]^2/2 + V(r)$ where V(r) is the atomic potential while A(t) is to be connected with the laser field. The existence and unicity for the Cauchy problem of the solutions of the corresponding Schroedinger equation are established under mild conditions on A(t) and V(r). The existence of Moeller operators is investigated in two cases, namely, when the laser field is a function of time only and when it vanishes asymptotically in time. Special attention is paid for the Coulomb case for which a "distorted" Moeller operator is derived. (DE)

15594 INTENSITY RATIOS OF L, M, N, O SUBSHELL CONVERSION ELECTRONS IN M3 AND E4 TRANSITIONS. Martin, B.; Merket, D.; Campbell, J. L. (Max-Planck-Institut fuer Kernphysik, Heidelberg (F. R. Germany)). Z. Phys., A; 274: No. 1, 15-21(Aug 1975).

8 figs.; 6 tabs.; 18 refs.

Conversion electron spectra from these E3 and four M4 transitions in ^{103}Rh, ^{109}Ag, ^{115}In, ^{125}Te, ^{134}Cs, ^{135}Ba, ^{193}Ir have been measured with the $(\pi/2)\sqrt{13}$ iron-free spectrometer with momentum resolution 0.5×10^{-3} to 1×10^{-3}. Intensity ratios of L, M, N, O conversion electrons show no significant departures from theory, but there is some evidence of error in the absolute values of outer-shell conversion coefficients calculated by the approximate method of Dragoun et al. (DE)

15595 AN INVESTIGATION OF THE L_2-L_3 COSTER-KRONIG TRANSITION PROBABILITY FOR $63 \leq Z \leq 96$. Nix, D. W.; Fink, R. W. (Georgia Inst. of Tech., Atlanta (USA). School of Chemistry). Z. Phys., A; 273: No. 4, 395-311(1975).

3 figs.; 3 tabs.; 41 refs.

The total transition probability f_{23} for the L_2-L_3 Coster-Kronig transition probability at Z = 80, 81, 82, and 92 was measured with L_α-$K_{\alpha 1,2}$ x-ray coincidences between high resolutions Si(Li) and Ge(HP) x-ray detectors and a dual-parameter multichannel coincidence system. The L_α gating technique for observing the K x-ray coincidence spectrum was carefully checked and found to be equivalent to the method of observing the L x-ray spectrum with $K_{\alpha 1,2}$ gates, when proper corrections are applied. The values of f_{23} found are 0.123 ± 0.012, 0.109 ± 0.011, 0.105 ± 0.011, and 0.146 ± 0.018 at Z = 80, 81, 82, and 92, respectively. These values, together with all previously published values in the region $57 \leq Z \leq 96$, are critically evaluated and a group of "best values" selected for comparison with theory. The agreement is quite good in the region $63 \leq Z \leq 83$. The screened nonrelativistic hydrogenic results of Chen, Crasemann, and Kostroun are in satisfactory agreement with the experiments. (DE)

15596 RADIATIVE CORRECTIONS TO THE RATES OF FORBIDDEN M1 TRANSITIONS IN ATOMS. Lin, D. L. New York; Columbia Univ. (1975). 199p. University Microfilms Order No. 75-25,698.

Thesis (Ph. D.).

By using quantum electrodynamics, the radiative corrections to the rates of atomic M1 transitions are examined to the lowest order, i.e., including graphs containing one virtual photon. The formulas of the correction operators are obtained and applied to some specific transitions. It is found that the radiative corrections of hydrogenlike ions of relative order alpha are zero for the n S/sub ½/ yields n' S/sub ½/ + gamma due to the following two reasons. The first is the spherical symmetry of the atomic states under consideration. The second is that the potential is of the Coulomb type. For 3 P/sub ½/ yields 2 P/sub ½/ + gamma, the ratio of the corrections to the uncorrected matrix element is found to be 1.01 alpha/pi. The radiative corrections to forbidden transition in heliumlike atoms are also discussed. To relative order alpha, the corrections to the transitions n $^3S_1$ yields n' $^1S_0$ + gamma are zero when the electron-electron interaction is neglected. The reasons are essentially the same as in the hydrogenic case. If the electron-electron interaction is also included, the correction is of relative order alpha/Z. For the case of 2 $^3S_1$ yields 1 $^1S_0$ + gamma, it is 0.97 alpha/pi Z. (Diss. Abstr. Int., B)

15597 TRIPLY EXCITED STATES OF THREE-ELECTRON ATOMIC SYSTEMS (He^-, Li, Be^+, etc.). Ahmed, M. Lincoln, NB; Univ. of Nebraska (1974). 100p. University Microfilms Order No. 75-16,877.

Thesis (Ph. D.).

Three-electron atomic systems are studied using many-product functions made up of single electron configurations. The calculations focus exclusively on the energy levels for the triply excited states. As basis functions, product functions were chosen which are antisymmetric in two of the particles but not in the third. The formalism developed using these basis functions is quite general in its scope. It is applicable to the calculation of singly and doubly excited levels in three-electron systems as well. The calculations are restricted to the triply excited energy levels using the one-electron hydrogenic functions with a 'Z' equal to that of the nucleus. The use of the present formalism adds clarity and simplicity as compared to the conventional approach of employing the totally anti-symmetric basis functions. The relation between the two approaches is investigated in some detail. It is shown that, in the present formalism, it is not necessary to evaluate explicitly the Coefficients of Fractional Parentage (CFP's), and to remove degeneracies due to 'Seniority' which arise in the case of equivalent particles. Results of the calculation of energy levels for $^2P^0$ and ^2S/sup e/ triply excited states in the Li-isoelectronic sequence are presented. The calculation for the energies of ^2D/sup e/ triply excited states in He^- are also reported. The calculated energies are compared with the available experimental values. Finally, the lowest ^2S/sup e/ and the two lowest $^2P^0$ energy levels for the Li-isoelectronic sequence are fitted to a 1/Z-perturbation expansion (Z ranges from 1 to 10). (Diss. Abstr. Int., B)

15598 HYPERFINE STRUCTURE OF 15-d ^{205}Bi AND ISOTOPE SHIFT FROM ^{209}Bi. Marino, C. A. New York; New York University (1975). 125p. University Microfilms Order No. 75-22,909.

Thesis (Ph. D.).

The hfs of 15-d ^{205}Bi(I equals 9/2) was measured in the spectrum of the $6p^27s$ ^4P/sub ½/-$6p^3$ ^4S/sub 3/2/ 3067-A line. Some 10^{15} ^{205}Bi atoms were produced with the Princeton University cyclotron, mainly in a ^{207}Pb(p,3n)^{205}Bi reaction; the target was natural lead. After chemical separation, the ^{205}Bi fraction was enriched in the Argonne National Laboratory mass separator. Electrodeless lamps, containing approximately 10^{13} atoms, were prepared, and spectra were recorded photographically with the use of a 25-cm blazed diffraction grating, used in autocollimation near 63°, and mounted in a 10-m focal length Czerny-Turner monochromator. Measurements were made of the positions of the F equals 6 yields 6 (100 percent), F equals 5 yields 5 (51 percent), F equals 4 yields 5 (34 percent) and the center of gravity of the F equals 4 yields 4 (51 percent) and the F equals 4 yields 3 (54 percent) ^{205}Bi components relative to the F equals 5 yields 5 (51 percent) ^{209}Bi component (relative intensities in parentheses). The hyperfine interval between the F equals 5 yields 5 and the F equals 4 yields 5 components was used to obtain ^{205}A(^4P/sub ½/) equals 166(4) mK. Neglecting hfs anomalies, this gives ^{205}A(^4S/sub 3/2/) equals −15.1(4) mK, for the magnetic-dipole interaction constant, or a magnetic dipole moment mu(^{205}Bi) equals 4.13(11) n.m. Calculations of the magnetic-dipole moment, which include configuration mixing and pion exchange contributions are substantially in agreement with this value. The hfs interval between the F equals 5 yields 5 and the F equals 5 yields 6 components could be used to obtain only a rough estimate for the electric-quadrupole interaction constant ^{205}B(^4S/sub 3/2/) approximately equal to −2. +- 18. mK. The ^{205}Bi-^{209}Bi isotope shift is equals 190(23) mK, with ^{205}Bi at the lower wave number. (Diss. Abstr. Int., B)

15599 MICROWAVE AND OPTICAL STUDIES OF A HELIUM AFTERGLOW. Castell, F. R. Pittsburgh; Univ. of Pittsburgh (1974). 119p. University Microfilms Order No. 75-18,229.

Thesis (Ph. D.).

Investigations of dissociative recombination between molecular ions He_2^+ and electrons were carried out as a function of the electron temperature, T/sub e/, up to approximately 1.5 eV in order to provide optimal conditions for its occurrence. Observations of the spectral line profile of the lambda6678 emissions during the afterglow did not reveal the characteristic line broadening of the dissociative process. However, the broadening may have been masked as a result of large excitation transfer cross sections between the excited atoms (3^1D and 3^3D) and the ground state (1^1S) helium atoms. By using proper electron density values, it has been possible to correlate afterglow atomic radiation intensity with the square of the electron density during the early afterglow indicating the occurrence of two-body electron-ion recombination. Afterglow quenching of the type expected if electron-ion recombination is the source of the excited atoms and molecules is observed. The principal afterglow processes found in these studies are strong electron production by metastable-metastable ionizing collisions balanced by enhanced ambipolar diffusion loss. The $He(2^3S)$ metastable-metastable ionizing coefficient at 300°K is found to be $(1.7 \pm 0.3) \times 10^{-9}$ cm^3/sec in good agreement with previous results. An electron production term sensitive to the electron mean energy—possibly electron impact ionization of metastable atoms—is deduced from pulsed microwave heating experiments. (Diss. Abstr. Int., B)

15600 MULTIPHOTON IONIZATION PROBABILITY OF ATOMIC HYDROGEN AND ATOMIC HELIUM IN INTENSE, CIRCULARLY POLARIZED LIGHT. Mian, S. Carbondale, IL; Southern Illinois Univ. (1975). 77p. University Microfilms Order No. 75-16,275.

Thesis (Ph. D.).

There has been much interest in the phenomenon of breakdown of gases due to a focused Q-switched laser beam. The mechanism responsible for initiating the breakdown is considered to be the ionization of atoms through the simultaneous absorption of several photons from the incident radiation. The present investigation is based on a perturbation method introduced by Henneberger which yields an effective potential determined by the time-average of the combined effects of the Coulomb and the electromagnetic fields. The solution of the Schroedinger equation with this effective potential gives the energy eigenvalue which corresponds to the intensity-dependent ionization potential. The eigenfunctions determine the initial state of the atom in the presence of radiation. Using the time-dependent part of the combined potential as a perturbation, the ionization probability is calculated in the first order S-matrix theory. Ionization potentials computed for H and He atoms are compared with those obtained by Choi (for plane polarized case) for the equivalent intensity. For low intensities the effective ionization potential is independent of the nature of polarization. At higher intensities, however, circularly polarized radiation seems to be more efficient in the multiphoton processes. For ionization probabilities due to circularly polarized light, indirect comparison is made with those for the case of plane polarization. A reasonably good agreement with the experimental results is found for light intensities in the visible region. (Diss. Abstr. Int., B)

15601 THERMOMAGNETIC TORQUE IN THE HYDROGEN ISOTOPES. Cramer, J. A. College Station; Texas A and M Univ. (1975). 74p. University Microfilms Order No. 75-25,088.

Thesis (Ph. D.).

The thermomagnetic torque has been measured in para hydrogen and ortho and normal deuterium for pressures from 0.10 to 2.0 torr and temperatures from 100 to 370°K. Since the torque depends on the precession of the molecular rotational magnetic moment around the field direction, coupling of the molecular nuclear spin to the rotational moment can affect the torque. Evidence of spin coupling effects is found for the torque in both deuterium modifications. In para hydrogen the torque at all temperatures and pressures exhibits behavior expected of a gas of zero nuclear spin molecules. Data are compared with theory. The torque in HD and normal hydrogen is also discussed. (Diss. Abstr. Int., B)

15602 CALCULATION OF POTENTIAL ENERGY CURVES FOR THE GROUND STATE OF THE HYDROGEN MOLECULE. Wilson, S.; Gerratt, J. (Bristol Univ., Eng.). Mol. Phys.; 30: No. 3, 777-787(Sep 1975).

Potential energy curves for the $X^1\Sigma_g^+$ state of H_2 are calculated from three wave functions which, in spite of their conceptual simplicity, yield results of remarkable accuracy. The three functions yield 87.06, 91.07 and 93.14 per cent of the observed binding energy, and provide an accurate description of the system over a wide range of nuclear separations. The fundamental vibration frequency is calculated for each curve, and the long-range behaviour of the wave functions is examined. (auth)

15603 OBSERVATIONS IN LIFETIMES AND EXCITATION PROCESSES FOR THE UPPER STATES IN ATOMIC HELIUM. Thompson, R. T. (National Aeronautics and Space Administration, Langley, VA); Fowler, R. G. J. Quant. Spectrosc. Radiat. Transfer; 15: No. 11, 1017-1024(Nov 1975).

Lifetime observations have been made on 49 energy levels of helium. Good overall agreement with theory is obtained, with significant exceptions, the most striking of which are the 3^1D and 3^3D states, where 50% discrepancies with theory and some of the older measurements are found. The new measurements are, however, in harmony with recent results using the Hanle effect. The existence of the upperstate transfer process is clearly delineated by the results for $n > 6$. (auth)

15604 TESTING INTERMOLECULAR POTENTIAL FUNCTIONS USING TRANSPORT PROPERTY DATA. II. Thermal Conductivities of Mixtures of Helium with the Hydrogen Isotopes. Clifford, A. A.; Colling, L.; Dickinson, E.; Gray, P. (Leeds Univ., Eng.). J. Chem. Soc. (London), Faraday Trans., I; 71: No. 10, 1962-1977 (1975).

The thermal conductivities of mixtures of helium with three hydrogen isotopes are reported at 77.6 and 283.2 K. Each system exhibits a negative "excess" thermal conductivity, which, with the single exception of helium + hydrogen deuteride at 283.2 K, can be predicted from the Hirschfelder-Eucken equation in conjunction with a realistic helium-hydrogen potential function. As has been asserted previously, the minima in the plots of thermal conductivity against composition for helium + hydrogen deuteride at 283.2 K, and helium + hydrogen at both temperatures, are not the product of any special cross-relaxation effects: they are due simply to the closeness of the pure component conductivities. Taken together with viscosities and second virial coefficients from the literature, the results are used to test four He/H_2 intermolecular potentials: (1) a Lennard-Jones (12:6) function derived from the Lorentz-Berthelot combining rules; (2) a Lennard-Jones (12:6) function derived from the Smith and Kong combining rules; (3) a function derived from molecular beam scattering studies; (4) an ab initio theoretical function. The theoretical potential (4) is the most successful in reproducing the bulk property measurements; the Lennard-Jones (12:6) Lorentz-Berthelot potential (1), the least. While there is little to choose between potentials (2) and (3) at 283.2 K, the molecular beam function is better at the lower temperature. (auth)

15605 TESTING INTERMOLECULAR POTENTIAL FUNCTIONS USING TRANSPORT PROPERTY DATA. I. Viscosity of Hydrogen from 273 to 1060°K. Clifford, A. A.; Dickinson, E.; Gray, P.; Scott, A. C. (Leeds Univ., Eng.). J. Chem. Soc. (London), Faraday Trans., I; 71: No. 10, 1953-1961(1975).

The viscosity of hydrogen has been measured at eight temperatures from 273 to 1060°K, using a capillary-flow viscometer. The results have been used to test the repulsive part of a recently formulated H_2/H_2 intermolecular potential function, obtained from molecular-beam measurements. Agreement between the experimental and predicted values for viscosity is within 3.5%, which corresponds approximately to the combined quoted uncertainties in the two sets of data. However, if the value of the distance parameter of the potential is reduced by about 1.5%, the agreement obtained is within 0.75% over the whole temperature range. This modified potential function gives better agreement with the available higher temperature viscosities and second virial coefficients. (auth)

15606 LAMB SHIFT IN HELIUM FROM A SELF-CONSISTENT FIELD THEORY OF ELECTRODYNAMICS. Yu, H.; Sachs, M. (State Univ. of New York, Buffalo). Int. J. Theor. Phys.; 13: No. 2, 73-88(Jun 1975).

In this paper the results of an investigation of the finite self-consistent field theory of electrodynamics applied earlier to the calculation of the Lamb shift in hydrogen are now applied to the problem of the Lamb shift in the low-lying states of Helium. The covariant nonlinear field equations of this theory is constructed for Helium, from the Lagrangian formalism. In the linear approximation, the Hamiltonian associated with this field theory for the two-electron atom is set up. It is equivalent to the Breit Hamiltonian plus two extra terms. The energy spectrum predicted for the Helium atom is the spectrum predicted by the Breit Hamiltonian, shifted by amounts in the different energy states according to the effects of the extra terms in the Hamiltonian. The latter can be associated with the corrections to the Helium spectrum that are conventionally attributed to the Lamb shift. The level shifts for the 1^1S and 2^1S states are calculated using the Foldy-Wouthuysen transformation, with the generalization of Charpivy for the two-electron atom. The results are found to be in close agreement with the experimental values for the energy shifts not predicted by the Dirac theory, and with the theoretical values predicted by quantum electrodynamics. (auth)

15607 UNIFIED THEORY OF STARK BROADENING FOR HYDROGENIC IONS. I. A General Theory (Including Time

Ordering). Greene, R. L. (Univ. of Colorado, Boulder); Cooper, J.; Smith, E. W. J. Quant. Spectrosc. Radiat. Transfer; 15: No. 11, 1025-1036(Nov 1975).

The formalism of the Unified Classical Path Theory of Stark broadening is extended, by use of a technique developed by Lisitsa and Sholin, to include the effects of time-ordering in the calculation of the required time-development operator. In addition, hyperbolic classical paths are considered so that the theory is valid for hydrogenic ions, as well as for the straight line paths of neutral hydrogen. (auth)

15608 OBSERVABILITY OF ROTATIONAL AND VIBRATIONAL SPECTRA OF ISOTOPICALLY ASYMMETRIZED HOMONUCLEAR DIATOMIC IONS. Bernstein, R. B. (Univ. of Texas, Austin); Certain, P. R. Comments At. Mol. Phys.; 5: No. 1, 27-31(Sep 1975).

Reference is made to the pseudo-homonuclear diatomic ions HD^+, $^3He^4He^+$, $^{12}C^{13}C^+$, $^{14}N^{15}N^+$ and $^{16}O^{18}O^+$, with special reference to their dipole moments. The values of these moments are stated to be within an order of magnitude of those of typical heteronuclear diatomic molecules, implying that the infra-red and microwave spectra of the ions should be observable, both in absorption in the laboratory and emission from interstellar cloud sources. Laboratory measurements of such spectra would be valuable, both because of the significance of the molecular structure data thereby obtained and because a knowledge of the transition frequencies would facilitate the search for such ions in the interstellar medium. Recent measurements of the microwave spectra of neutral molecules, such as CO, HCN, H_2CO, etc., in certain interstellar clouds have revealed anomalous enrichments of the rarer isotopic species with respect to their terrestrial abundances, for example ^{13}C, ^{15}N, ^{18}O, etc. This suggests the possibility of observing rotational spectra of a hitherto inaccessible class of molecular ions, referred to as isotopically substituted asymmetrized homonuclear diatomic ions, that possess significant dipole moments. With the increasing availability of space platforms and observatories it should soon be possible to carry out a search for the spectra of such ions. Laboratory experimental approaches are also briefly discussed. (UK)

15609 UNIFIED THEORY OF STARK BROADENING FOR HYDROGENIC IONS. III. Results for He II Lyman-α. Greene, R. L.; Cooper, J. (Univ. of Colorado, Boulder). J. Quant. Spectrosc. Radiat. Transfer; 15: No. 11, 1045-1053(Nov 1975).

Calculations have been performed for He II Lyman-α using a previously developed theory in which the effect of time-ordering in the required time development operator is retained. Representative results are given for an electron density of 10^{17} cm^{-3} and a temperature of 40,000°K. Compared with non-time ordered results, these profiles are about 17% lower at line center and up to 16% higher in the wings. In addition, since the perturbing electron is speeded up by the Coulomb attraction, in comparison with neutral hydrogen the static results are not obtained until much further into the line wings. Comparison is also made to the calculations of Kepple for which good agreement is obtained, except near the line center where the difference approaches 25%. (auth)

15610 KINETICS OF He($2\,^1S$) USING RESONANCE IONIZATION SPECTROSCOPY. Payne, M.G.; Hurst, G.S.; Nayfeh, M.H.; Judish, J.P.; Chen, C.H.; Wagner, E.B.; Young, J.P. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). Phys. Rev. Lett. 35: No. 17, 1154-1156 (27 Oct 1975).

We have demonstrated that quantum selected populations of He(2^1S) can be converted completely to ionization by single-photon excitation to He(3^1P) followed by collision-induced associative ionization. For helium pressures between 15 and 100 Torr, saturation of ionization was observed whenever a tunable dye laser produced more than 0.1 J/pulse. Absolute numbers of He($2\,^1S$) per ion pair formed from proton interaction and the decay rates of He(2^1S) support a recent energy-pathways model. (auth)

15611 FESHBACH AND SHAPE RESONANCES IN THE e-H ^1P SYSTEM. Lin, C.D. (Center for Astrophysics, Harvard College Observatory and Smithsonian Astrophysical Observatory, Cambridge, Massachusetts 02138). Phys. Rev. Lett. 35: No. 17, 1150-1153 (27 Oct 1975).

Using a Born-Oppenheimer-type expansion for the two-electron wave functions in hyperspherical coordinates, three potential curves are obtained for H^- ^1P states converging to the $n=2$ state of the hydrogen atom. It is shown that the Feshbach resonances are associated with one curve and the shape resonance with another. The connections with the "+" and "−" classification of helium doubly excited states and with the asymptotic dipole-field representation of H^- are discussed. (auth)

15612 DETERMINATION OF $g_J(^4He\,2^3S_1)/g_J(^1H,\,^2S_{1/2})$: RESOLUTION OF A DISCREPANCY. Keiser, G.M.; Robinson, H.G. (Duke University, Durham, North Carolina 27706); Johnson, C.E. Phys. Rev. Lett. 35: No. 18, 1223-1225 (3 Nov 1975).

A new measurement of the g_J factor in the 2^3S_1 metastable state of ^{4}He has been made using an optical-pumping technique. Our result is $g_J(^4He,2^3S_1)/g_J(^1H,^2S_{1/2}) = 1-23.15(10)\times10^{-6}$. This value agrees with theory and provides confirmation of a recent atomic-beam measurement. Further doubt is cast on an earlier optical-pumping determination, thereby resolving a possible discrepancy between theory and experiment. (auth)

15613 EXPERIMENTAL DETERMINATION OF THE SINGLE-PHOTON TRANSITION RATE BETWEEN THE $2\,^3S_1$ AND $1\,^1S_0$ STATES OF He I. Woodworth, J.R.; Moos, H.W. (Department of Physics, The Johns Hopkins University, Baltimore, Maryland 21218). Phys. Rev. A 12: No. 6, 2455-2463 (Dec 1975).

The highly forbidden single-photon transition rate between the $2\,^3S_1$ and $1\,^1S_0$ states of He I has been measured in a radio-frequency He discharge. The population of metastables in the $2\,^3S_1$ state was determined by Fabry-Perot interferometric profiles of absorption from the $2\,^3S_1$ to the $4\,^3P_{0,1,2}$ states. High spectral resolution and precision ultraviolet radiometry were used to determine the brightness of the emission feature observed at 625.54 ± 0.05 Å, compared to the theoretical value of 625.56 Å. Because of the very low transition rate, this feature is weak, but it is shown that it is due to the $2\,^3S_1$-$1\,^1S_0$ transition. The value for the radiative transition rate obtained in these experiments was 1.10×10^{-4}/sec, with a 2σ uncertainty of ± 30%. A comparison to the theoretical value of 1.27×10^{-4}/sec is given. The relevance of this work to the beam-foil experiments which have measured the $2\,^3S_1$-$1\,^1S_0$ transition rate for high-Z He-like ions is also discussed. (auth)

15614 NEW INTERPRETATION OF RESONANCES IN H_2^-. Chang, E.S. (Department of Physics and Astronomy, University of Massachusetts, Amherst, Massachusetts 01002). Phys. Rev. A 12: No. 6, 2399-2401 (Dec 1975).

The two interspersed series of resonances experimentally observed in e-H_2 scattering at 11–13 eV are identified as $^2\Sigma_g^+$ (series I) and $^2\Delta_g$ (series II), both in the configuration $(1s\,\sigma_g)(2p\,\pi_u)^2$. This interpretation leads to a natural explanation that series I is strong while series II is weak in the $X\,^1\Sigma_g^+$ and in the $B\,^1\Sigma_u^+$ channels, and that the two series are equally strong in the $c\,^3\Pi_u$ channel. Angular distributions for these resonances are computed and compared with experiment. Some old expressions are corrected, and new expressions are given for decay into the $c\,^3\Pi_u$ channel. (auth)

15615 CHARGE-TRANSFER ENERGY IN CLOSED-SHELL ION–ATOM INTERACTIONS. Alvarez-Rizzatti, M. (University of Costa Rica, Costa Rica, Central America); Mason, E.A. J. Chem. Phys. 63: No. 12, 5290-5295 (15 Dec 1975).

The importance of charge-transfer energy in the interactions between closed-shell ions and atoms is investigated. *Ab initio* calculations on H^+–He and Li^+–He are used as a guide for the construction of approximate methods for the estimation of the charge-transfer energy for more complicated systems. For many alkali ion–rare gas systems the charge-transfer energy is comparable to the induction energy in the region of the potential minimum, although for doubly charged alkaline-earth ions in rare gases the induction energy always dominates. Surprisingly, an empirical combination of repulsion energy plus asymptotic induction energy plus asymptotic dispersion energy seems to give a fair representation of the total interaction, especially if the repulsion energy is parameterized, despite the omission of any explicit charge-transfer contribution. More refined interaction models should consider the charge-transfer energy contribution. (auth)

15616 PARALLEL POLARIZABILITIES OF DIATOMIC MOLECULES VIA THE PARTIAL-WAVE SCF PROCEDURE. McCullough, E.A. Jr. (Department of Chemistry and Biochemistry, UMC 03, Utah State University, Logan, Utah 84322). J. Chem. Phys. 63: No. 11, 5050-5051 (1 Dec 1975).

The results of polarizability calculations on several small diatomic molecules using the recently implemented partial-wave self-consistent-field (PWSCF) method are reported. These calculations were done with the sigma orbital version of the PWSCF program so that only α_{zz}, the polarizability tensor component parallel to the internuclear axis, could be computed. The results are compared with matrix SCF (MSCF) results and with exact results, where available. (AIP)

15617 OSCILLATOR STRENGTH SUMS $S(-3)$ TO $S(2)$ AND C_6 FOR THE ATOMS He TO Kr. Cummings, F.E. (Department of Chemistry, Atlanta University, Atlanta, Georgia 30314). J. Chem. Phys. 63: No. 11, 4960-4966 (1 Dec 1975).

The oscillator strength sums $S(2)$, $S(1)$, and $S(-1)$ calculated using analytical Hartree–Fock wavefunctions and the sums $S(-2)$ and $S(-3)$ from an approximate uncoupled Hartree–Fock calculation are given for the atoms He to Kr. Trends are discussed as well as the accuracy of the Hartree–Fock calculations. An extensive compilation of accurate sums is used to assess the relative usefulness and accuracy of recently proposed bounds and approximations to the spherically averaged dispersion coefficient C_6. Values of C_6 for the first three rows are presented. (auth)

15618 IONIZATION ENERGIES OF QUADRUPLY IONIZED RARE EARTHS. Sugar, J. (National Bureau of Standards, Washington, D. C. 20234). J. Opt. Soc. Am. 65: No. 11, 1366-1367 (Nov 1975).

Values for the ionization energies of four-times-ionized lanthanides are derived from interpolated spectroscopic properties of the $4f^{N-1}ns$ Ryberg series. (auth)

15619 THEORETICAL STUDY OF H^+_2 SPECTROSCOPIC PROPERTIES. IV. ADIABATIC EFFECTS FOR THE $2p\pi_u$ AND $3d\sigma_g$ ELECTRONIC STATES. Bishop, D.M.; Shih, S. (Department of Chemistry, University of Ottawa, Ottawa, Canada K1N 6N5); Beckel, C.L.; Wu, F.; Peek, J.M. J. Chem. Phys. 63: No. 11, 4836-4841 (1 Dec 1975).

Adiabatic corrections to the potential curves for the $2p\pi_u$ and $3d\sigma_g$ states of H^+_2 are reported. The effects of these corrections in altering spectroscopic properties of H^+_2 are described in some detail; likely consequences are indicated in two astrophysical applications. (auth)

15620 RADIATIVE AND PREDISSOCIATIVE LIFETIMES OF THE $V'=0$, 1, AND 2 LEVELS OF THE $A\,^2\Sigma^+$ STATE OF OH AND OD. German, K.R. (Bell Telephone Laboratories, Holmdel, New Jersey 07733). J. Chem. Phys. 63: No. 12, 5252-5255 (15 Dec 1975).

A direct measurement of the fluorescent decay rates of the $V'=0$, 1, 2 vibrational levels of the $A\,^2\Sigma^+$ state of OH and OD has been performed using pulsed laser excitation and at total gas pressures of less than 1 mTorr. The present experiment is the first in which lifetime measurements have been performed for individual rotational levels (N') of each of the three lowest vibrational states of both OH and OD and at pressures where both quenching and excitation transfer should be minimal. The radiative lifetime was found to increase slightly for the higher vibrational levels in agreement with a model of linear decrease of the transition moment with increasing internuclear separation. The measured radiative lifetimes, $\tau_{V'}\pm(3\sigma)$, for OH were $\tau_0=693\pm30$ nsec, $\tau_1=736\pm33$ nsec and for OD were $\tau_0=691\pm27$ nsec, $\tau_1=712\pm30$ nsec, $\tau_2=736\pm39$ nsec. The $V'=2$ level of OH was found to be strongly predissociated with a predissociation lifetime of about 270 ± 25 nsec at $N'=1$. An analysis of the energies at which predissociation occurs leads to the conclusion that the repulsive $^4\Sigma^-$ state is responsible for all the observed predissociations for $V'\leq2$ in both OH and OD. (auth)

15621 MOLECULAR POLARIZABILITIES AND SUSCEPTIBILITIES FROM FROST-MODEL WAVEFUNCTIONS. Amos, A.T.; Yoffe, J.A. (Department of Mathematics, The University o. Nottingham, England). J. Chem. Phys. 63: No. 11, 4723-4729 (1 Dec 1975).

Average polarizabilities and susceptibilities of a number of molecules are computed from Frost-model wavefunctions using a form of symmetry-adapted double perturbation theory. The anisotropy of α and χ is found for a few molecules using the elliptical Gaussian form of the Frost model. The results obtained are in reasonable agreement with experiment and other calculated values. (auth)

Positronium, Muonium, and Muonic and Mesic Atoms and Molecules

Refer also to abstract 16111.

15622 (JUL-Conf-13, pp 43-59) DIFFERENCES IN THE ANNIHILATION OF POSITRONS IN OPTICAL ISOMERS. Garay, A. S. (Biological Research Center, Szeged); Keszthelyi, L.; Demeter, I.; Hrasko, P. Nov 1974.

From international symposium on generation and amplification of asymmetry in chemical systems; Juelich, F. R. Germany (24 Sep 1973).

In international symposium on generation and amplification of asymmetry in chemical systems. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany)).

Differences were observed in the lifetime spectra from positron annihilation in L and D isomers of some amino acids. The intensity of the triplet component was found to be greater in D isomers than in L isomers. Two possible explanations are discussed. (auth)

15623 (JUL-Conf-13, pp 513-521) COMMENTS ON THE EXPERIMENTS CONCERNING INTERACTION BETWEEN β-PARTICLES AND CHIRAL MOLECULES. Garay, A. S. (Biological Research Center, Szeged). Nov 1974.

From international symposium on generation and amplification of asymmetry in chemical systems; Juelich, F. R. Germany (24 Sep 1973).

In international symposium on generation and amplification of asymmetry in chemical systems. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany)).

Five series of experiments—altogether 33 combinations — are reviewed in which differential interactions of β^- particles with chiral molecules was studied. The great majority of experiments gave negative results. Critical considerations show, however, that all experiments suffer from some shortcomings; thus the question is open for further studies. (auth)

15624 COMPARISON OF SOME REACTIONS OF POSITRONIUM, THE ELECTRON, AND ATOMIC HYDROGEN. Gol'danskii, V. I.; Koldaeva, O. V.; Shantarovich, V. P. (Inst. of Physical Chemistry, Moscow). High Energy Chem. (USSR) (Engl. Transl.); 9: No. 1, 55-60(1975).

Translated from Khim. Vys. Energ.; 9: No. 1, 70-76(1975).

The experimentally observed gas-phase reaction of nonthermalized positronium, $Ps + Cl_2 \rightarrow PsCl + Cl$, in the liquid phase (cyclohexane) leads to inhibition of positronium formation. Thus a case of "apparent" inhibition is observed. A similar effect apparently also occurs in solutions of hydrogen peroxide and triphenylmethylcarbinol. The absence of inhibition of positronium formation by Br_2 and I_2 in the presence of quenching arises from the fact that the cross section for the reaction $Ps + Hal_2 \rightarrow PsHal + Hal$ in the epithermal region is two to three orders of magnitude smaller when Hal = Br, I than when Hal = Cl, and possibly also from a reaction of thermal positronium of the type $Ps + Hal_2 \rightarrow PsHal_2$, which is enhanced on passing from Cl_2 to I_2. Analogues of the reactions of thermal and nonthermalized positronium in chemistry are traced. 2 figs, 1 table, 33 refs (auth)

15625 DETERMINING THE MOMENTUM DISTRIBUTION OF ANNIHILATION: ELECTRON–POSITRON PAIRS FROM ANGULAR CORRELATION CURVES. Gol'danskii, V. I.; Tatur, A. O.; Shishkin, A. V. (Moscow Engineering Physics Inst.). Dokl. Akad. Nauk SSSR; 223: No. 1, 76-79(1 Jul 1975). (In Russian).

A simple, statistically-based method of determining the momentum distribution of positron-electron pairs by the numerical solution of a first order, Fredholm equation on a computer with the use of a method of statistical regularizations utilizing probability distribution functions is proposed. Momentum distributions were determined in benzene and a two-molar solution of nitrobenzene in benzene. The presence of positronium could be detected in benzene, but was absent in the two-molar nitrobenzene solution. Analogous results had been previously obtained for water. (SJR)

15626 STRONG INTERACTIONS IN K-MESONIC ATOMS. Torigoe, E. W. Stanford, CA; Stanford Univ. (1975). 185p. University Microfilms Order No. 75-25,620.

Thesis (Ph. D.).

A very general theoretical description of the effects of the strong interactions on the lower cascade in K-mesonic atoms is derived by applying the theory of the decay of a prepared state. Except for requiring small energy-level shifts and widths in comparison with transition energies, the treatment of these effects is essentially exact. Included among the results of the analysis are the rates for K-meson absorption into specific final states as well as the generalized K-meson optical potential for evaluating energy-level shifts and widths. The methods of many-body theory are used to obtain a diagrammatic representation for this optical potential. A relatively simple model for calculating energy-level shifts and widths and the properties of absorption products is developed on the basis of the localization of the strong interactions between K-meson and nucleus in the nuclear periphery. For this model—referred to as the impulse-approximation model—the effects of the nucleon binding potential and the exclusion principle are neglected. In addition, the non-local K-meson optical potential is approximated by a local potential following the nuclear density. Results of numerical studies are presented showing that the strength parameters of this local potential are weakly dependent on (1) the distortion of the K-meson wavefunction by the strong interactions, (2) the atomic level occupied by the K-meson and (3) the specific nucleus. Predictions of the model are in fairly good overall agreement with experimental results, but detailed comparisons are not possible due to the uncertainty of the subthreshold scattering amplitudes. Quantitative comparisons are made between the non-local K-meson optical potential and the local potential of the impulse-approximation model. The basic assumptions of the model are discussed in detail. (Diss. Abstr. Int., B)

15627 MODEL POTENTIAL THEORY FOR POSSIBLE APPLICATIONS TO POSITRON ANNIHILATION. Jean, Y. J. Milwaukee; Marquette, Univ. (1974). 111p. University Microfilms Order No. 75-14,988.

Thesis (Ph. D.).

A quantum mechanical study is done of model potential theory for positron-atom systems, both bound and scattering. The difficulties of obtaining an accurate wave function to interpret the positron annihilation parameters by the variational approach, even for the simple e^+H system, are mentioned. Existing model potentials and pseudopotentials are reviewed and none of them are found to be directly applicable to positronic systems. A simple and the-

oretically based model potential method is proposed which is suitable to perform the calculations to a good accuracy. (Diss. Abstr. Int., B)

15628 NEW RESULTS FROM MESONIC ATOMS. Bachenstoss, G. (Karlsruhe Univ. (TH) (F. R. Germany); European Organization for Nuclear Research, Geneva (Switzerland)). pp 12-23 of Mesonic Effects in Nuclear Structure. Proceedings. Bleuler, K. (ed.). Mannheim, F. R. Germany; Bibliographisches Institut (1975).

From symposium on mesonic effects in nuclear structure in remembrance of K. Erkelenz; Bonn, F. R. Germany (29 Jan 1974). 3 figs.; 2 tabs.; 13 refs.

A survey is given on new results for energy shift and absorption width of pionic ^{9}Be-, ^{6}Li-, ^{7}Li- and ^{4}He-atoms and kaonic ^{10}B-, ^{12}C-, ^{31}P- and S-atoms. The deviations between experimental results and theoretical predictions by phenomenological potentials are discussed. (DE)

15629 POSITRONIUM SPIN CONVERSION IN Li-AMMONIA SOLUTION. Bisi, A.; Bosi, L. (Gruppo Nazionale di Struttura della Materia del C.N.R., Istituto di Fisica del Politecnico di Milano, Italy); Lazzarini, E.; Zappa, L. J. Chem. Phys. 63: No. 12, 5087-5089 (15 Dec 1975).

The time spectrum of positrons annihilated in lithium-ammonia solutions of various concentrations was analyzed. It was found that the decay rate of the longest lived component increases at the same time as the Li concentration increases; likewise its intensity increases until it attains 100% at high concentration. The results are interpreted in terms of electron exchange collisions which convert triplet positronium to singlet and vice versa. The triplet to singlet conversion rate γ was found proportional to the number of Li atoms dissolved per unit volume. (auth)

Collision Phenomena

Refer also to abstracts 15552, 15599, 15600, 15607, 15609, 15611, 15614, and 15615.

15630 (AD/A-007073) ASSOCIATIVE IONIZATION IN COLLISIONS OF URANIUM AND OTHER METAL ATOMS WITH ATMOSPHERIC SPECIES. Final Report, 15 October 1971–14 October 1974. Fite, W. L., Lo, H.; Irving, P.; Siegel, M. W.; Brackmann, R. T. (Extranuclear Labs., Inc., Pittsburgh, Pa. (USA)). 15 Nov 1974. Contract F19628-72-C-0080. 46p. NTIS $3.75.

Experimental studies of associative ionization reactions involving uranium and other metal atoms in collisions with O, O_2 and other atmospheric species are described. The first experiments determined the ratio of cross sections for the U + O and the U + O_2 reactions. The second determined the absolute cross section for the U + O_2 to UO_2^+ + e process. Crossed-beam experiments in which a metal atom beam containing both U and a second metal atom (Ti, Gd, Zr, Th, Ba) was crossed by a beam of either O_2 or O were performed to determine the associative ionization cross sections for Ti + O, Zr + O, Gd + O, Th + O and Th + O_2. Crossing a U atom beam with a gas beam containing O_2 and N_2O yielded an absolute cross section for U + N_2O to UO^+ + N_2. Other associative ionization processes were observed, among which were U + NO to UNO^+ + e and Ba + OH to $BaOH^+$ + e. (GRA)

15631 (COO-1106-1) THEORETICAL RESEARCH ON CHARGE EXCHANGE OF URANIUM IONS AT THERMAL ENERGIES. Bardsley, J. N. (Colorado Univ., Boulder (USA); Pittsburgh Univ., Pa. (USA). Dept. of Physics). 1975. Contract E(04-3)-1106. 13p. Dep. NTIS $3.50.

The cross section for resonant charge transfer in U^+-U collisions is calculated as a function of the energy in the center-of-mass coordinate frame. The computed value decreases monotonically from approximately 300 A^2 at 0.025 eV to 100 A^2 at 50 eV. The latter value would be appropriate for ions of energy 100 eV moving through a gas of neutral atoms at thermal velocities. (auth)

15632 (N-75-14576) COLLISIONS OF METASTABLE ATOMS OF He* 2^3S WITH HELIUM AND NEON, AND OF Ne^+ IONS WITH HELIUM. Kalinin, A. P.; Leonas, V. B. (AN SSSR, Moscow). 1974. Translation of Pr-187. (NASA-TT-F-16117). 16p. NTIS $3.25.

The differential scattering was studied of beams of He* 2^3S and Ne* in He and Ne. The experimental functions for the systems He*–He and He(+)–He are compared with functions calculated from the potentials. Deviations are found between the calculated and the measured curves. This deviation is eliminated for the system He*–He by modifying the trend of the adiabatic term. Functions of the potential energies of interaction corresponding to the adiabatic term of the system He*2 and to that of the system He*–Ne are found. An analytical approximation of the potentials is proposed. (auth)

15633 USE OF THE KOLOS–WOLNIEWICZ POTENTIAL FOR COLLINEAR VIBRATIONAL EXCITATION OF H_2 BY He. Clark, A. P.; Dickinson, A. S. (Stirling Univ., Eng.). J. Phys., B (London); 8: No. 14, L364-L367(1 Oct 1975).

The calculations of Drake and Holt for the collinear collision of He + H_2 have been repeated using more accurate H_2 vibrational wavefunctions. The transition probabilities are reduced by approximately 10%, showing the sensitivity of this process to the intramolecular potential employed. Transition probabilities for an equivalent Morse potential are also presented. (auth)

15634 MEASUREMENT OF TOTAL DIFFERENTIAL CROSS SECTIONS IN THE SCATTERING OF 40 keV ELECTRON BY ARGON ATOMS. Electron Correlation Effect. Duguet, A. (Paris-11 Univ., 91–Orsay (France)); Jaegle, A. (Centre Universitaire de Mulhouse, 68 (France)). J. Phys. (Paris), Lett.; 36: No. 7, L.193-L.195(Jul 1975). (In French)

The measurement of the total differential cross section for 40 keV electrons scattered by argon atoms shows the effect of electronic correlations by comparison with theoretical total differential cross sections calculated from Hartree-Fock wave functions and from correlated wave functions. (FR)

15635 ROTATIONAL EXCITATION OF LINEAR TRIATOMIC MOLECULES: Ar, Kr + N_2O, CO_2. Farrar, J. M.; Parson, J. M.; Lee, Y. T. (Univ. of Chicago). pp 214-227 of Proceedings of the Fourth International Symposium on Molecular Beams. Chicago; University of Chicago (1973).

From 4th international symposium on molecular beams; Cannes, France (9 Jul 1973).

Rotational excitation of N_2O and CO_2 in collisions with Ar and Kr was studied by crossing two supersonic molecular beams and detecting scattered products with a mass spectrometer. Measurement of the time-of-flight spectrum of the products as a function of laboratory scattering angle THETA indicates that the inelasticity is concentrated in the forward direction in the center-of-mass system. Differences between CO_2 and N_2O are discussed briefly. 6 figures. (auth)

15636 REACTION DYNAMICS OF THE SYSTEM $NH_2^+ + D_2$. Hillman, J. J. Washington, DC; American University (1975). 158p. University Microfilms Order No. 75-18,570.

Thesis (Ph. D.).

An ion-beam-scattering cell apparatus has been constructed to experimentally determine the kinematics of reactive ion-molecule scattering processes. Using this apparatus the ion-molecule reactions: $NH_2^+ + D_2$ yields $NH_2D^+ + D$, DELTA H^0 equals -1.26 ev; $NH_2^+ + D_2$ yields $NHD_2^+ + H$, DELTA H^0 equals -1.26 ev; $NH_2^+ + D_2$ yields $NHD^+ + H + D$, DELTA H^0 equals 4.52 ev; have been investigated. The relative abundances of the various observed ionic products have been measured over the relative energy range from 3 ev to 15 ev. Doppler broadening, due to target motion, and excess kinetic energy from the primary ion formation process have been included in the determination of the translational energy threshold for the observed NHD^+ product. The corrected threshold occurs at 6.1 ev, indicating the relative inefficiency of translational energy in overcoming this endothermic barrier. By measuring the center of mass product velocity distributions it is observed that: (1) The NH_2D^+ product ion is formed by a spectator stripping process. This product ion is observed to be highly internally excited, almost to the point of dissociation. This is verified by observing the isoflux contour map of this product. (2) The observation of an enhanced NHD^+ product signal above the collision-induced dissociation energy of the target molecule is suggestive of the occurrence of a 2-step process of excitation of NH_2D^+ followed by fragment recoil. This process leads to broadened velocity distributions which peak below the spectator stripping prediction. This observation verifies the conclusion that the NHD^+ ion is not formed by the unimolecular decomposition of highly internally excited NH_2D^+ from the spectator stripping process. (Diss. Abstr., Int., B)

15637 CALCULATION OF TOTAL CROSS SECTIONS FOR THE IONIZATION OF ATOMIC SYSTEMS BY CHARGED PARTICLE IMPACT USING THE GLAUBER APPROXIMATION. Golden, J. E. Manhattan, KS; Kansas State Univ. (1975). 162p. University Microfilms Order No. 75-25,032.

Thesis (Ph. D.).

The Glauber approximation is applied to the ionization of atomic systems by charged particle impact. A technique of evaluating the Glauber scattering amplitude for ionizing collisions which makes use of Pade approximants is described and this method is applied to the ionization of atomic hydrogen by electron impact. Problems associated with the use of this technique of evaluation are discussed and more efficient and rigorous analytic techniques are developed which allow the Glauber scattering amplitude to be expressed as a one dimensional integral.

This new analytic method is applied to the evaluation of cross sections for the ionization of hydrogen and helium by electron and proton impact. In the case of helium the sensitivity of the calculated cross sections to the choice made for the bound and continuum target functions is discussed and illustrated by numerical examples. The Glauber cross sections for the ionization of these two systems by electron impact are in better agreement with the experimental data than are calculations made using the Born approximation. It is not clear that the same statement can be made for the ionization of those systems which involve protons as projectiles due in part to the inadequate nature of the experimental data. Possible problems associated with the application of the Glauber approximation to ionizing collisions involving heavy particles as projectiles exist and have been discussed. It is speculated, on the basis of recent results for K-shell vacancy production in neon by proton impact, that, with the possible exception of problems associated with charge transfer to the continuum, such effects are of no more importance for the ionization of atoms by proton impact than they are for electron impact. With respect to the application of the Glauber approximation to the ionization of multielectron atoms several additional problems have been briefly discussed. (Diss. Abstr. Int., B)

15638 HIGH RESOLUTION STUDY OF THE CHARGE STATE DEPENDENCE OF ION-INDUCED X RAYS. Kauffman, R. L. Manhattan, KS; Kansas State Univ. (1975). 120p. University Microfilms Order No. 75-25,042.

Thesis (Ph. D.).

The K alpha x-ray structure of neon is studied as a function of the incident projectile's specie, charge state, and energy. Beams of carbon, nitrogen, oxygen, fluorine, and chlorine having incident energy between 1 and 2 MeV/amu are used. Previous results for argon are included in the analysis. A curved crystal spectrometer is used to resolve the x rays into a number of peaks labeled KL/sup n/ for N equals 1, . . ., 7 where n is the number of L-shell vacancies of the neon ion. The energies of the observed peaks in the spectra are given and compared with calculations and previous measurements. Relative x-ray intensities are obtained as a function of the initial hole configuration of neon by correcting the KL^5 and KL^6 peaks for overlap of the three-electron x-ray intensity in the KL^5 peak. Semi-empirical fluorescence yields are applied to obtain relative multiple ionization cross sections. These cross sections are fitted to a binomial distribution as predicted by Coulomb ionization. All cases give good fits except for the F^{+9} induced spectra. The fitting parameter can be interpreted as the probability for L-shell ionization at zero impact parameter, P/sub L/(0). The predictions P/sub L/(0) by the binary encounter approximation are an order of magnitude larger than the results of the fit. Tables of Hartree-Fock calculations of the x-ray and Auger transitions of neon are given. No excitation states and only single K-shell vacancy states are considered. L–S coupling is used. (Diss. Abstr. Int., B)

15639 ABSOLUTELY DOUBLY DIFFERENTIAL CROSS SECTIONS FOR PRODUCING SECONDARY POSITIVE IONS FROM 50–200 keV Ar^+–Ar COLLISIONS AND 50–200 keV H^+ COLLISIONS WITH He, Ar, H_2 AND N_2. Crooks, J. B. Lincoln, NB; Univ. of Nebraska (1974). 238p. University Microfilms Order No. 75-16,889.

Thesis (Ph. D.).

Secondary positive ions with energy/unit charge ranging from 2 to 5500 eV were observed under single collision conditions at angles 10^0, 30^0, 50^0, 70^0, 110^0, 130^0, 160^0, and at a series of closely spaced angles ranging from 84^0 to 95^0. The ions were analyzed by an electrostatic analyzer and were detected by an electron multiplier. Doubly differential cross sections are calculated from the slit geometry. For the atomic targets the angular distribution is sharply peaked between 84^0 and 92^0. For protons on He and Ar, the peak angle for ion energies greater than 20 eV is approximately that for elastically recoiling He^+ and Ar^+. For Ar^+ on Ar the angular distribution results from a complex superposition of ions of differing charge and widely varying inelastic energy loss. In H^+ collisions with H_2 and N_2, more than 99 percent of all ions with energy greater than 2 eV are atomic ions from dissociative processes. Dissociative ionization cross sections obtained by numerical integration over both energy and angle agree quite well with the data of Browning and Gilbody. Structures are seen in the energy distributions: for H^+ on H_2, at 5.5 eV and 9.0 eV; for H^+ on N_2, at 3.85, 5.0, and 7.6 eV. No significant anisotropy of the peak (9.0 eV) of the H^+ ion energy is observed. This result contrasts markedly with electron impact work where as much as 3 to 1 anisotropy is observed. (Diss. Abstr. Int., B)

15640 SIMPLIFIED MULTICHANNEL VARIATIONAL METHOD FOR ATOMIC SCATTERING CALCULATIONS. Ajmera, M. P. Raleigh, NC; North Carolina State Univ. (1975). 106p. University Microfilms Order No. 75-17,096.

Thesis (Ph. D.).

Based on Feshbach projection operator formalism and Kohn's variational principle, the Kohn-Feshbach variational method is constructed. This method is further simplified because the evaluation of continuum-continuum integrals encountered in its application becomes very difficult for l greater than 0. The effectiveness of the simplified method is illustrated by its applications to the problem of P-wave elastic scattering of electrons by atomic hydrogen. The application of the simplified method is extended to the multichannel scattering process. 1s–2s excitation cross sections are calculated by computing the R matrix elements for various incident electron energies. Excellent convergence is obtained for all the energies tested, including the region very close to the inelastic threshold. The wave function calculated for e–H elastic scattering using the simplified method provides a free state function for the H^- ion. This is used to calculate the photodetachment cross section of the negative hydrogen ion. The absorption coefficients are calculated using two types of bound state wave functions, one with separable coordinates and the other with correlation between the two electrons explicitly included. The result is compared with the best of the available theoretical results as well as with the experimental result. The cross sections in the resonance region are also obtained and the shape parameter, namely, the q-value which characterizes the background cross section is calculated. To test the exactness of the bound and free state wave functions, the absorption coefficients are calculated using both the dipole velocity and length formulae. The result signifies some improvement over the previous calculations. (Diss. Abstr. Int., B)

15641 K-SHELL IONIZATION CROSS SECTIONS FOR ELEMENTS Se TO Pd: 0.4 TO 2.0 MeV. Criswell, T. L. Denton, TX; North Texas State Univ. (1974). 82p. University Microfilms Order No. 75-13,667.

Thesis (Ph. D.).

K-Shell ionization cross sections for protons over the energy range of 0.4 to 2.0 MeV have been measured on thin targets of the elements Se, Br, Rb, Sr, Y, Mo and Pd. Total x-ray and ionization cross sections for the K-shell are reported. The experimental values of the ionization cross sections are compared to the non-relativistic plane-wave Born approximation, the binary-encounter approximation, the constrained binary-encounter approximation, and the plane-wave Born approximation with corrections for Coulomb-deflection and binding energy effects. (Diss. Abstr. Int., B)

15642 ROTATIONAL EXCITATION IN SLOW COLLISIONS OF HELIUM WITH THE DIATOMIC HYDRIDES: HF, DF, HCl, AND DCl. Collins, L. A. Houston, TX; Rice Univ. (1975). 236p. University Microfilms Order No. 75-22,008.

Thesis (Ph. D.).

The results of quantum mechanical close-coupling calculations of the cross sections for rotational excitation of the lowest four (j less than or equal to 3) rotational levels of hydrogen fluoride (HF), deuterium fluoride (DF), hydrogen chloride (HCl), and deuterium chloride (DCl) by collisions with ground state helium (He) atoms at energies (c.m.) between 0.015 eV and 0.15 eV in the coupled-channel and j/sub z/-conserving coupled-state formulations are presented and discussed. The molecules are treated as linear rigid rotors, and the calculations are performed by an integral equations technique. The total rotational excitation cross sections calculated in the coupled-channel and coupled-state formulations are in good agreement for all hydride systems. In many cases, excitation cross sections involving the higher rotor states (j greater than or equal to 2) are comparable in size to those for transitions connecting the lower excited states. A simple, approximate procedure is developed for modeling the potential energy surfaces for the interaction between helium and the diatomic hydrides. The model interaction surface for He–HF compares favorably with a more accurate restricted Hartree–Fock surface. Simple models of the scattering process are used to qualitatively understand the behavior of the rotational excitation cross sections. Comparison of the cross sections for the same transition between different hydride systems yields certain trends in the behavior of the cross sections which can be interpreted in terms of the relative size of the interaction surfaces and the spacing of the rotor levels. (Diss. Abstr. Int., B)

15643 THREE DIMENSIONAL METHOD FOR ATOM–DIATOMIC MOLECULE REACTIONS, WITH APPLICATIONS. Elkowitz, A. B. Austin, TX; Univ. of Texas (1975). 166p. University Microfilms Order No. 75-16,667.

Thesis (Ph. D.).

Three dimensions are used in a close coupling scheme employing natural collision coordinates to obtain reaction probabilities for the two path reaction $H + H_2$ yields $H + H_2$ and for a model one

reaction path system in which hydrogen is used as a test case. In both cases, vibrational non-adiabaticity is included and the non-conservation of probability is seen not to occur. The calculation of reaction probabilities at total angular momentum J equals 0 is reported for the one and two path hydrogen exchange reactions. The energy range covered is 0.50 to 0.90 eV total system energy, and transition probabilities are computed from all asymptotically open input channels to all open output channels (states of the H_3 molecule in the separated atom-molecule limit). These reaction probabilities are discussed and the dynamics of the reaction as it proceeds through the transition state is considered. (Diss. Abstr. Int., B)

15644 CROSSED-BEAM STUDIES OF ION–MOLECULE REACTIONS. Vestal, M. L. Salt Lake City; Univ. of Utah (1975). 217p. University Microfilms Order No. 75-18,038.

Thesis (Ph. D.).

A new crossed-beam apparatus for the study of ion-molecule collision processes is described. Among the novel features of this apparatus are a high pressure "chemical ionization" ion source, an apertureless exponential ion deceleration lens, a product ion mass/energy analyzer that can be scanned in angle through nearly a full octant of a sphere, and a supersonic nozzle molecular beam source. The high pressure source can be used to produce vibrationally relaxed ground state reactant ions and the deceleration lens produces focused ion beams with energies as low as 0.1 eV at intensities equal to the space charge limit. The results of a detailed study of the reaction $H_3^+ + D_2$ yields $D_2H^+ + H_2$ and its isotopic analogs are presented. Results are also reported on the reactions $H_3^+ + Ar$ yields $ArH^+ + H_2$ and $H_3^+ + N_2$ yields $N_2H^+ + H_2$. The experimental results are presented as contour maps of relative intensity normalized for Cartesian velocity coordinates plotted superimposed on the Newton diagram as described by Cross and Wolfgang. The data are also presented in an intensity contour plot using the relative translational energy and center-of-mass scattering angle as rectangular coordinates. Product angular distributions obtained by integrating the contour diagrams over the relative translational energy distributions are also given. A new dynamical model, the "modified elastic spectator" is developed and applied to the interpretation of the experiments. This model, which is an extension of the impulsive reaction model of Chang and Light, yields results in good agreement with the experimental measurements. (Diss. Abstr. Int., B)

15645 TOTAL AND SINGLE ELECTRON CHARGE–EXCHANGE CROSS SECTIONS OF He^+ INCIDENT UPON He, Ne, AND Ar IN THE ENERGY RANGE 500–5000 eV. Eisele, F. L. Burlington, VT; Univ. of Vermont (1975). 101p. University Microfilms Order No. 75-23,170.

Thesis (Ph. D.).

A $He^+(1s)$, monoenergetic ion beam was used to bombard He, Ne, and Ar target gases in a dual-purpose scattering chamber. The total charge-exchange cross section was measured using a parallel-plate collection method for low-energy target ions, while the total cross section was obtained via the beam-attenuation technique. The difference between these two cross sections is the non-charge-exchange cross section which is observed to decrease monotonically with increasing energy for each of the target gases used. The symmetric resonant charge-exchange cross section of He^+ + He was also found to decrease with increasing energy. Asymmetric charge-exchange cross sections on the other hand were found to increase with an increase in incident ion velocity as expected within this energy range. A presentation of theories relevant to the present experimental measurements is included, as well as a description of the apparatus and a discussion of the experimental procedures and analysis. Where previously obtained experimental results are available, a comparison to the present data shows relatively good agreement. (Diss. Abstr. Int., B)

15646 THEORETICAL CALCULATIONS OF ELECTRON-IMPACT AND RADIATIVE PROCESSES IN ATOMS. Pindzola, M. S. Charlottesville, VA; Univ. of Virginia (1975). 110p. University Microfilms Order No. 75-26,009.

Thesis (Ph. D.).

Electron-impact and radiative processes in atoms are investigated with particular attention paid to the effects of electron correlations. Using the optical potential method, the cross section for the elastic scattering of electrons by the neutral argon atom is calculated from 0 to 300 eV. Corrections to the Hartree–Fock cross section are obtained from a many-particle perturbation expansion. The effects of electron correlations are found to be quite significant at low energy. The optical potential results are compared with a polarized orbital calculation, the Born approximation and experiment. The 2s and 2p excitation cross sections for electron scattering on hydrogen are calculated by two similar methods. The distorted wave method is applied and the effect of calculating the outgoing scattered electron in the potential of the initial or final state is investigated. The imaginary part of the optical potential is also calculated in lowest order by the use of many-body diagrams. The subshell photoionization cross sections in argon are calculated using the acceleration, length and velocity forms of the dipole operator. First order electron correlation corrections to the Hartree–Fock approximation are obtained through the use of many-body perturbation theory. Also investigated is the two photon ionization cross section for the neutral argon atom. A double perturbation expansion in the Coulomb correlations and the atom-radiation field interaction is made. Contributions from intermediate states are obtained by direct summation over Hartree–Fock bound and continuum single particle states. The effects of electron correlations and photon radiative corrections are investigated. (Diss. Abstr. Int., B)

15647 ELECTRON DENSITY DISTRIBUTION IN ATOMS AND MOLECULES. The Hologram of the Free Argon-Atom. Fink, M. (Texas Univ., Austin (USA). Dept. of Physics). Phys. Bl.; 31: No. 9, 396-406(Sep 1975). (In German).

11 figs.; 13 refs.

The method is described to get knowledge of the electron density distributed of atoms by a hologram-like method of electron scattering on atoms and molecules. (DE)

15648 IONIZATION FUNCTION OF MAGNESIUM FOR ELECTRON IMPACT. Karstensen, F.; Schneider, M. (Kiel Univ. (F. R. Germany). Inst. fuer Experimentalphysik). Z. Phys., A; 273: No. 4, 321-323(1975).

3 figs.; 7 refs.

Ionization cross sections for electron impact are measured with crossed beams of Mg atoms and pulsed electrons. Total numbers of particles are determined by the light emission of excited atoms. The ionization cross section obtained for electron energies from 7 eV to 60 eV has its maximum value q_i (max) = 7.8×10^{-16} cm^2 at 12 eV electron energy. (DE)

15649 TOTAL CROSS SECTION MEASUREMENTS FOR CHARGE EXCHANGE OF He^{++} IONS WITH He AND Ar ATOMS. Schrey, H.; Huber, B. (Bochum Univ. (F. R. Germany). Inst. fuer Experimentalphysik 2). Z. Phys., A; 273: No. 4, 401-403(1975).

3 figs.; 6 refs.

Total charge exchange cross sections were measured for He^{++} in He and Ar gas in the energy range from 50 to 540 eV using a single beam apparatus. For He^{++} in He the measured cross section is in agreement with calculations for symmetric resonant charge exchange. For He^{++} in Ar the cross section for charge exchange decreases with decreasing energy below 300 eV. The measured cross section suggests the formation of Ar^+ ions to be more important at lower energies and the production of Ar^{++} to be dominant at higher energies. (DE)

15650 ATOMIC STATES OF LITHIUM BY THE BEAM-FOIL TECHNIQUE IN THE SPECTRAL RANGE 400-1,900 A. Schuermann, D. (Bochum Univ. (F. R. Germany). Inst. fuer Experimentalphysik 3). Z. Phys., A; 273: No. 4, 331-338(1975).

7 figs.; 6 tabs.; 18 refs.

$^6Li^+$-ions accelerated electrostatically to energies of 200-390 keV are electronically excited by the beam-foil technique. The emitted light is analyzed with a Seya-Namioka VUV monochromator in the wavelength range 400-1,900 A. All Li II and Li III lines known from theory – in one case emitted by a n = 9 level – are detected, several of them for the first time. Lifetimes of 20 Li II levels are determined after correction for cascades. The accuracy of the experimental values for several lifetimes is better than that of theoretical predictions. (DE)

15651 UNIFIED THEORY OF STARK BROADENING FOR HYDROGENIC IONS. II. Line Wings. Greene, R. L.; Cooper, J. (Univ. of Colorado, Boulder). J. Quant. Spectrosc. Radiat. Transfer; 15: No. 11, 1037-1044(Nov 1975).

The consequences of the attractive Coulomb force between positively charged hydrogenic radiators and electrons on line broadening in the quasistatic wings are examined. Due to the speeding up of the electrons by the Coulomb attraction, static results are not obtained until further out into the wings for (e.g.) He II lines, as compared to the analogous hydrogen lines. In fact, for low principal quantum numbers the region of validity is outside of, or close to, the limit $\hbar\Delta\omega \lesssim kT$ imposed by the weak coupling approximation. The effects of doubly-excited bound states are discussed in detail and it is concluded that within the validity range of the Unified Theory all except possibly the most tightly bound doubly-excited states (which can give rise to "satellites" to the ionic lines) are relatively unimportant. In the near line wings the profile goes approximately as $\Delta\omega^{-\frac{5}{2}}$. But in the far line wings ($\hbar\Delta\omega \gtrsim kT$) the wings lie somewhat above the $\Delta\omega^{-\frac{5}{2}}$ wing of neutral species and a $\Delta\omega^{-\frac{3}{2}}$ dependence is more appropriate. No exponential divergence of the spectrum is obtained for large $\Delta\omega$ when bound states (for which a classical distribution

of states is inappropriate) are excluded. Unfortunately, no conclusive experimental comparisons are possible with presently available data. (auth)

15652 ATOMIC COLLISION RESEARCH IN JAPAN. Takayanagi, K. (Tokyo Univ.). Comments At. Mol. Phys.; 5: No. 1, 13-18(Sep 1975).

A brief review is given of recent research studies in the field of atomic collisions in Japan. The review is based on a recently published Progress Report (No. 2) entitled "Studies of Atomic Collisions and Related Topics in Japan", containing more than 50 papers, and available from the present author. (UK)

15653 QUANTAL CLOSE-COUPLING STUDIES OF EXCITED ALKALI-METAL–RARE-GAS COLLISIONS. Wilson, A. D. (Bar-Ilan Univ., Ramat-Gan, Israel); Shimoni, Y. J. Phys., B (London); 8: No. 14, 2393-2414(1 Oct 1975).

Quantal close-coupling calculations for $Na(3^2P_{|m_l|})$-$He(^1S)$ collisions are presented. Two versions of the interatomic potential are investigated in the temperature range 400 K to 4500 K. The cross sections for population transfer, multipole relaxation and coherence transfer appropriate to gas-phase experiments, and the population transfer cross sections for beam experiments, are opacity analyzed and the opacity functions are studied as a function of l. The ranges of l contributing to depolarization and inelastic processes overlap and cross sections are of similar magnitude. The potential beyond $R \simeq 14a_0$ does not contribute to the cross sections. Rotation of the internuclear axis is the main transition mechanism. At high temperatures, all the cross sections decrease with temperature. Beam experiments cannot indicate the results of gas-phase experiments. The results are compared with experiment and approximate theories. (auth)

15654 QUANTAL STUDIES OF ALKALI-METAL–RARE-GAS COLLISIONS. III. Broadening of NaD lines by He. Wilson, A. D. (Bar-Ilan Univ., Ramat-Gan, Israel); Shimoni, Y. J. Phys., B (London); 8: No. 14, 2415-2426(1 Oct 1975).

Fully quantal calculations of the width and shift of the Na D doublet due to collisions with $He(^1S)$ in the temperature range 400 $K \leq T \leq 4500$ K are presented. The complex cross section is opacity analyzed and the complex opacity functions are studied as a function of l. Two versions of the interatomic potential previously reported are studied. The statistical approximation can be used at low l and can reproduce the total width with the cut-off impact parameter decreasing with increasing temperature. Inelastic processes contribute significantly to the width. The width of the D_2 lines is slightly greater than the D_1 line, the shift is an order of magnitude smaller than the width and the difference between the shifts is constant with temperature. The potential above $R \geq 14$ au does not influence the width but the shift is affected by $R \leq 21$ au. The shift but not the width depends on which potential is used. The widths are in good agreement with experiment and classical path calculations so that use of the classical path approximation seems to be justified. The shifts are in less good agreement and are sensitive to the path. (auth)

15655 EFFECT OF TIME-ORDERING FOR LYMAN-α. Greene, R. L.; Cooper, J. (Univ. of Colorado, Boulder). J. Quant. Spectrosc. Radiat. Transfer; 15: No. 11, 991-993(Nov 1975).

Numerical calculations of the wings of the hydrogen Lyman-α line due to Stark broadening by electrons have been performed including time ordering effects. It is concluded that two recent calculations, which apparently disagree, are numerically correct within their respective approximations and their differences are explained. (auth)

15656 POSITRON-HYDROGEN SCATTERING BY THE FADDEEV APPROACH. Mandal, P.; Saha, B.C.; Sil, N.C. (Department of Theoretical Physics, Indian Association for the Cultivation of Science, Jadavpur, Calcutta-700032, India). J. Chem. Phys. 63: No. 11, 4767-4771 (1 Dec 1975).

An approximate form of the Faddeev equations has been employed to investigate the e^+–H scattering problem with the inclusion of the couplings of the 1s, 2s, and 2p states of the hydrogen atom and the ground state of the Ps atom. As no experimental measurements have been reported until now, the present predictions with and without the inclusion of the Ps formation have been compared with other existing theoretical findings. In the low energy region the effects of the Ps-formation channel on the elastic cross sections have been found to be quite important. The present values for the Ps-formation cross section are slightly smaller than the FBA results. The results for 1s-2s and 1s-2p excitations are seen to be influenced considerably in the low energy region by the inclusion of the Ps-formation channel whereas from $E \gtrsim 150$ eV these results are very close to the corresponding FBA values. (auth)

15657 NEW SEMICLASSICAL TREATMENTS OF ROTATIONAL AND VIBRATIONAL TRANSITIONS IN HEAVY-PARTICLE COLLISIONS. I. H–H_2 AND He–H_2 COLLISIONS. McCann, K.J.; Flannery, M.R. (School of Physics, Georgia Institute of Technology, Atlanta, Georgia 30332). J. Chem. Phys. 63: No. 11, 4695-4707 (1 Dec 1975).

Two new semiclassical methods—the multistate orbital treatment and the multichannel eikonal treatment—are proposed for the description of rotational and vibrational excitation in heavy-particle collisions. The first method includes appropriate trajectories determined from a certain optical potential designed to couple the response of the internal structure, which is described by a quantal multistate expansion, to the orbit for the relative motion and vice versa. While this approach is, in general, valid when the quantal imprecision in the classical trajectories is small (as for heavy particles) the second method based on the use of a straight-line eikonal for the relative motion, of different local momenta in the various channels and of a multistate expansion for the internal motions, is valid for scattering mainly about the forward direction. These procedures are applied to representative rotational transitions in H–H_2 and He–H_2 collisions at 0.25–1.5 eV and yield angular distributions and integral cross sections in very close accord with corresponding quantal results. The methods are particularly valuable at higher impact energies when the inclusion of the resulting many rotational and vibrational channels by full quantal treatments is prohibitively difficult. Various approximate schemes—the perturbed-rotating-atoms approximation and the effective potential method—are also investigated. (auth)

15658 THE $A+B_x$ CONDENSATION REACTION: CROSSED NOZZLE BEAMS OF Br_2 AND $(Cl_2)_x$ OR $(NH_3)_x$ CLUSTERS. Behrens, R. Jr.; Freedman, A.; Herm, R.R.; Parr, T.P. (Inorganic Materials Research Division, Lawrence Berkeley Laboratory). J. Chem. Phys. 63: No. 11, 4622-4631 (1 Dec 1975).

Nozzle beams of Br_2 and Cl_2 or NH_3 have been crossed in a molecular beam scattering apparatus; the Cl_2 or NH_3 beam contained $(Cl_2)_x$ or $(NH_3)_x$ clusters distributed such that the intensity of a given cluster, F_x, decreased with increasing x for $1 \leqslant x \lesssim 50$. Mass, angular,[1] and time-of-flight spectra of the scattered neutral species all establish that the $A+B_x \rightarrow AB_x^*$ bimolecular condensation reaction is being observed. However, working from the data, it is not possible to distinguish between detection of a long-lived AB_x^* metastable complex or of a decomposition product formed with low recoil velocity. Product angular distributions are confined to a small region of laboratory scattering angle Θ and peak at small but positive Θ ($\Theta = 0°$ and 90° defined by cluster and Br_2 beam directions, respectively). It is pointed out that this sharp peaking at small Θ is due to a number of experimental factors, including a Jacobian factor varying as $\sin^{-2}\Theta$, and should be a universal characteristic of such condensation reactions in crossed beams. In the data it is indicated that there will be a high probability of fragmentation into small daughter ions upon electron bombardment (EB) ionization of an AB_x or B_x cluster for the range in x most sensitive to the measurements ($\sim 10 \leqslant x \lesssim 50$). This in turn implies that the concentration of neutral clusters in the beam can be seriously underestimated if the cluster ion mass spectra produced by EB ionization of the nozzle beam are assigned assuming that fragmentation is inconsequential. (auth)

15659 A SEMICLASSICAL, NONPERTURBATIVE APPROACH TO COLLISION-INDUCED TRANSITIONS BETWEEN ROTATIONAL LEVELS FOR THE N_2–Ar SYSTEM. Mehrotra, S.C.; Boggs, J.E. (Department of Chemistry, The University of Texas at Austin, Austin, Texas 78712). J. Chem. Phys. 63: No. 11, 4618-4621 (1 Dec 1975).

A semiclassical and nonperturbative approach in which coupling between translational and rotational degrees of freedom is also taken into account is developed to compute rotationally inelastic transition probabilities of linear molecule-atom collisions. This approach is applied to N_2–Ar collisions. The transfer of rotational, translational, and interaction energies is also computed during collisions. The results show that if the coupling between rotational and translational degrees of freedom is neglected, the computed transition probabilities change significantly for strong collisions, although there are no significant changes in the corresponding trajectories. (auth)

15660 EXCITATION FUNCTIONS FOR THE REACTIONS OF Ar^+ WITH CH_4, CD_4, AND CH_2D_2. Wyatt, J.R.; Strattan, L.W.; Chivalak, S.; Hierl, P.M. (Department of Chemistry, University of Kansas, Lawrence, Kansas 66045). J. Chem. Phys. 63: No. 11, 4582-4591 (1 Dec 1975).

Integral reaction cross sections as a function of initial translational energy (0.4–30 eV c.m.) are reported for isotopic variants of the exoergic ion-molecule reaction $Ar^+ + CH_4 \rightarrow ArH^+ + CH_3$. The excitation functions, which maximize at about 5 eV and decrease at lower collision energies, appear to possess translational energy thresholds at about 0.1 eV. At the higher energies there is a large isotope effect favoring abstraction of H over D. The observed threshold behavior, unusual for exoergic reactions of positive ions, is discussed in terms of the formation of an $ArCH_4^+$ intermediate complex at low collision energies. (auth)

15661 RELATIVISTIC UP-CONVERSION OF RADIATION FREQUENCY IN COLLIDING PHOTON AND ELECTRON BEAMS. Rivlin, L.A. (All-Union Scientific-Research Institute of Optophysical Measurements, Moscow). Sov. J. Quantum Electron. 5: No. 7, 764-766 (July 1975).

Approximate calculations are given of the feasibility of generation of directional x-ray pulses of up to 100 W power with a low relative line width. It is assumed that these pulses are generated as a result of the Compton scattering of laser photons by a relativistic high-density electron beam. (auth)

15662 DERIVATION OF DISPERSION RELATIONS FOR ATOMIC SCATTERING PROCESSES. Byron, F.W. Jr. (Department of Physics, University of Massachusetts, Amherst, Massachusetts 01002); de Heer, F.J.; Joachain, C.J. Phys. Rev. Lett. 35: No. 17, 1147-1150 (27 Oct 1975).

We point out that it now appears very likely that because of the properties of the exchange amplitude the customary forward dispersion relations do not hold for electron-atom elastic scattering. (auth)

15663 DIFFERENTIAL SCATTERING OF Na $3S_{1/2}$ AND $3P_{3/2}$ FROM Ne: DETERMINATION OF GROUND- AND EXCITED-STATE POTENTIALS FOR NaNe. Carter, G.M.; Pritchard, D.E.; Kaplan, M.; Ducas, T.W. (Department of Physics and Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). Phys. Rev. Lett. 35: No. 17, 1144-1147 (27 Oct 1975).

We report high-resolution measurements of the differential cross section for scattering Na in its $3S_{1/2}$ and $3P_{3/2}$ states from Ne. A new scheme is used to maintain a high fraction (~20%) of an atomic beam of Na in the excited state for many radiative lifetimes using a single-mode cw dye laser. The differential cross sections are interpreted to yield interatomic potential curves for both the $X\Sigma$ and $A\Pi$ states of the NaNe molecule which seriously disagree with recent pseudopotential calculations. (auth)

15664 QUASIMOLECULAR STATES RESPONSIBLE FOR QUANTUM-MECHANICAL PHASE INTERFERENCE IN LOW-ENERGY Na^+-Ne INELASTIC COLLISIONS. Tolk, N.H.; Tully, J.C.; White, C.W.; Kraus, J.; Monge, A.A. (Bell Laboratories, Murray Hill, New Jersey 07974); Neff, S.H. Phys. Rev. Lett. 35: No. 17, 1175-1178 (27 Oct 1975).

A simple model is presented which affords an unambiguous and quantitative determination of the quasimolecular states responsible for the striking oscillatory structure in the energy dependence of the polarization components of total cross sections for optical emission due to low-energy $Na^+ - Ne$ collisions. The $^1\Pi$ ($\Omega = \pm 1$) and $^3\Pi$ ($\Omega = \pm 2$) states are identified as the major participants in the quantum-mechanical phase-interference process and not the simple single-electron diabatic states as believed previously. (auth)

15665 MAGNETIC FIELD DEPENDENCE OF CROSS SECTIONS FOR COLLISIONAL DISORIENTATION OF $6\,^2P_{1/2}$ CESIUM ATOMS. Guiry, J.; Krause, L. (Department of Physics, University of Windsor, Windsor, Ontario, Canada). Phys. Rev. A 12: No. 6, 2407-2412 (Dec 1975).

The magnetic field dependence of the cross sections for the disorientation of $6\,^2P_{1/2}$ cesium atoms, induced in Cs-He collisions, has been studied using Zeeman scanning techniques. A Cs-He mixture, contained in a fluorescence cell which was located in a magnetic field variable from 0 to 10 kG, was irradiated with the circularly polarized 8943-Å component of cesium resonance radiation in a direction parallel to the field, and the polarization of the resonance fluorescence was monitored in the backward direction in relation to the helium pressure and to the magnetic field strength. The cross sections, which are in good agreement with the results obtained previously at high and low magnetic fields, exhibit a variation with the magnetic field, which is in accordance with theoretical predictions. (auth)

15666 l-DOMINANT STUDY OF ROTATIONALLY INELASTIC Li^+–H_2 COLLISIONS. DePristo, A.E.; Alexander, M.H. (Department of Chemistry, University of Maryland, College Park, Maryland 20742). J. Chem. Phys. 63: No. 12, 5327-5332 (15 Dec 1975).

For rotationally inelastic collisions at large total angular momentum J, the orbital angular momentum l exerts considerable dynamical importance. The inelastic T matrix is dominated by transitions between states characterized by small centrifugal barriers. Recognizing this fact, we have recently developed an "l-dominant" (LD) approximation to the space-fixed quantum-mechanical close-coupled (CC) equations, which consists in neglecting all channels with $l > J$. In the present work we have applied the LD method to the determination of partial and total cross sections for the $j=0 \rightarrow 2,4,6$ processes in Li^+–H_2 collisions at an energy of 0.5 eV. For the $0 \rightarrow 2$ and $0 \rightarrow 4$ transitions the LD results agree well with exact CC values, particularly at high J where the l dominance is most pronounced. By contrast, agreement is less satisfactory for the weak $0 \rightarrow 6$ transition, where high J values do not contribute significantly to the total cross section. Compared with the results of coupled-states (CS) calculations, the LD partial cross sections are considerably more accurate. In terms of computational expense, the LD method lies midway between CS and CC calculations. (auth)

15667 THE DEACTIVATION OF HF($v=1$) AND DF($v=1$) BY O, Cl, AND F ATOMS. Quigley, G.P.; Wolga, G.J. (Laboratory of Plasma Studies, Cornell University, Ithaca, New York 14853). J. Chem. Phys. 63: No. 12, 5263-5268 (15 Dec 1975).

The relaxation of vibrationally excited HF and DF by O, Cl, and F atoms at $T = 300$ °K has been measured by the laser induced fluorescence method. The rate constants in units of cm^3 $molecule^{-1}\text{-}sec^{-1}$ for HF($v=1$) are $k_{O\text{-}HF} = 3.1 \pm 0.6 \times 10^{-12}$, $k_{Cl\text{-}HF} = 7.4 \pm 1.6 \times 10^{-13}$, $k_{F\text{-}HF} = 2.8 \pm 0.6 \times 10^{-13}$; for DF($v=1$) they are $k_{O\text{-}DF} = 7.8 \pm 2.2 \times 10^{-12}$, $k_{Cl\text{-}DF} = 2.0 \pm 0.3 \times 10^{-12}$, $k_{F\text{-}DF} = 6.5 \pm 1.2 \times 10^{-13}$. The results provide further evidence for the validity of a vibronic to translational energy transfer mechanism. Atom transfer reactions are shown to be of no importance. (auth)

15668 MERGING BEAMS STUDY OF THE $H^+_3(D_2,H_2)HD^+_2$ REACTION MECHANISM. Lees, A.B.; Rol, P.K. (Research Institute for Engineering Sciences and The Department of Chemical Engineering and Material Sciences, Wayne State University, Detroit, Michigan 48202). J. Chem. Phys. 63: No. 12, 5077-5080 (15 Dec 1975).

Laboratory energy distributions of HD^+_2 product ions formed in the $H^+_3(D_2,H_2)HD^+_2$ reaction were measured for reactants with relative energy W in the range $0.1 \text{ eV} \leq W \leq 11.0$ eV. The results show that most of the product ions appear as a single peak, asymmetric with respect to the c.m. zero energy, and suggest predominantly direct interactions over the entire energy range studied. The relative energy of products, calculated from the position of the peak in the measured distribution, follows the predictions of the spectator stripping (SS) model for $W \leq 8$ eV. Above $W = 9$ eV the SS peak disappears and a product peak found at lower laboratory energies becomes dominant. (auth)

15669 HIGHER-ORDER DECOUPLING OF THE ELECTRON PROPAGATOR. Redmon, L.T.; Purvis, G.; Öhrn, Y. (The Quantum Theory Project, Department of Chemistry, University of Florida, Gainesville, Florida 32611). J. Chem. Phys. 63: No. 11, 5011-5017 (1 Dec 1975).

The decoupling of the electron propagator in the superoperator formalism is extended to include a description of processes corresponding to simultaneous electron ionization (or electron attachment) and double excitation, observed in electron spectrometry, by including products of five spin–orbital field operators in the inner projection basis. Although the terms thus introduced are fourth order in the electron interaction, an argument based on the self-consistent solution of the second-order equations suggests that these fourth-order terms are more important than the third-order terms. The argument is substantiated by numerical applications to the neon atom. A calculation using third-order shifts is compared with a calculation using the suggested fourth-order terms, but without third-order terms. (auth)

15670 DIFFERENTIAL CHARGE EXCHANGE CROSS SECTIONS IN AB^+–AB COLLISIONS. McCann, K.J.; Flannery, M.R.; Hornstein, J.V.; Moran, T.F. (Georgia Institute of Technology, Atlanta, Georgia 30332). J. Chem. Phys. 63: No. 11, 4998-5002 (1 Dec 1975).

Differential cross sections for vibrational excitation in $H^+_2(X\,^2\Sigma^+_g, v_0') - H_2(X\,^1\Sigma^+_g, v_0^*)$, $N^+_2(X\,^1\Sigma^+_g, v_0') - N_2(X\,^1\Sigma^+_g, v_0^*)$, $O^+_2(X\,^2\Pi_g, v_0') - O_2(X\,^3\Sigma^-_g, v_0^*)$, $CO^+(X\,^2\Sigma^+, v_0') - CO(X\,^1\Sigma^+, v_0^*)$, and $NO^+(X\,^1\Sigma^+, v_0') - NO(X\,^2\Pi, v_0^*)$ charge transfer reactions have been determined for incident ions with 0.004 to 2.2 keV kinetic energies. Differential cross sections for excitation of individual charge transfer channels have been computed as a function of scattering angle using a multistate impact parameter treatment of the collision processes. At low kinetic energies, converged cross sections are obtained with the inclusion of a relatively small number of product vibrational states in the wavefunction expansion of the system while a large number of product states must be included at higher energies. Small angle scattering within several degrees dominates the charge transfer, with the scattering becoming more concentrated in the forward direction at higher kinetic energies. (auth)

15671 THE DIMENSIONALITY AND CHOICE OF EFFECTIVE HAMILTONIANS FOR MOLECULAR COLLISIONS. Rabitz, H. (Department of Chemistry, Princeton University, Princeton, New Jersey 08540). J. Chem. Phys. 63: No. 12, 5208-5215 (15 Dec 1975).

The flexibility in choice of effective Hamiltonians is illustrated by considering various different dimensionality reducing procedures. Only a few members of the entire family of effective Hamiltonians have thus far been employed in actual computations. All the effective Hamiltonians are presented for two colliding molecules, and the reduced atom–molecule situation is also considered. The two-molecule case in body-fixed coordinates is treated in more detail since it has not been extensively examined before. Exactly analogous space-fixed and body-fixed dimensionality reductions are shown to be possible by appropriate selection and coupling of states. The available ranges of computing expense are discussed and the various methods related in these terms.

Computing time and accuracy requirements are examined in regard to choosing an effective Hamiltonian. Further avenues of pursuit and calculations are suggested by these considerations. (auth)

15672 COMPARISON OF CLASSICAL, DISTORTED WAVE, AND STRAIGHT PATH METHODS OF EVALUATING THE INTEGRALS OVER THE INTERMOLECULAR TRAJECTORY DURING MOLECULAR COLLISIONS. Sharma, R.D.; Hart, R.R. (Physics Department, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). J. Chem. Phys. 63: No. 12, 5383-5389 (15 Dec 1975).

The integrals over the intermolecular trajectory, relevant to pressure-broadening and energy transfer calculations, are evaluated for the classical path, straight path, and distorted wave approximations. The present work, coupled with previous published work, leads to the conclusion that the three approximations agree to within 25% for near-resonant collisions involving reduced energies $E^* \gtrsim 1$. For nonresonant collisions the classical calculation, which does not conserve energy, is in surprisingly good agreement with the distorted wave results even when the energy mismatch is one-half of the incident energy. (auth)

15673 TOTAL CROSS SECTION MEASUREMENTS FOR THE SCATTERING OF ARGON BY ALIPHATIC HYDROCARBONS. Nenner, T.; Tien, H.; Fenn, J.B. (Department of Engineering & Applied Science, Yale University, New Haven, Connecticut 06520). J. Chem. Phys. 63: No. 12, 5439-5444 (15 Dec 1975).

Absolute values of total cross sections have been determined for the scattering of a monoenergetic molecular beam of argon by 30 aliphatic hydrocarbons. Included are the normal paraffins, cycloparaffins, olefins, and acetylenes with from one to eight carbon atoms. Also included are two diolefins and three butene isomers. Values are reported for the cross section at a relative velocity of 555 m/s. The van der Waals coefficients from the experimental data generally are within a few percent of those calculated by the Slater–Kirkwood approximation. (auth)

15674 COLLISION DYNAMICS OF THREE INTERACTING ATOMS: THE MULTIPLE-COLLISION EXPANSION. Micha, D.A.; Yuan, J. (Quantum Theory Project, Departments of Chemistry and Physics, University of Florida, Gainesville, Florida 32611). J. Chem. Phys. 63: No. 12, 5462-5469 (15 Dec 1975).

Inelastic, atom–exchange, and dissociative atom–diatomic collisions are described by means of a multiple-collision expansion of the Faddeev equations for three atoms. Collision processes are described by a superposition of stripping, single-, double-, and so on, atom–atom encounters. The corresponding probability amplitude terms are expressed as integrals in momentum variables which require for their evaluation only two-body t matrices and the initial and final distributions of diatomic momenta. Analysis of these integrals leads to the spectator- and recoil-stripping models, and to kinematics rules that indicate whether a process may occur by single collisions or not. The kinematic rules are applied to (a) inelastic and reactive collisions of $Ar^+ + H_2$ and its isotopic variations; (b) inelastic collision of $NO^+ + He$; and (c) inelastic collision of $Li^+ + H_2$, in order to illustrate their value in interpreting experimental results. (auth)

15675 REPULSIVE POTENTIALS FOR Na^+–R AND Al^+–R (R = RARE GAS ATOMS) DERIVED FROM BEAM EXPERIMENTS. Kita, S.; Noda, K.; Inouye, H. (Research Institute for Scientific Measurements, Tohoku University, 19–1 Sanjyo-machi, Sendai 980, Japan). J. Chem. Phys. 63: No. 11, 4930-4932 (1 Dec 1975).

Repulsive potentials for Na^+–R and Al^+–R (R=rare gas atoms) are derived from integral scattering experiments using the projectile ions in the energy range 0.5–4 keV. The potentials are well represented by an exponential formula, $V(R) = A\exp(-\alpha R)$. The numerical values of the parameters, A (eV) and α (Å^{-1}), are Na^+–He, 1200, 4.92; Na^+–Ne, 5350, 5.12; Na^+–Ar, 11 340, 4.68; Na^+–Kr, 9600, 4.33; Al^+–He, 325, 3.50; Al^+–Ne, 1220, 3.93; and Al^+–Ar, 3170, 3.86. The statistical computation published by Kim and Gordon [J. Chem. Phys. 60, 4323 (1974)] for Na^+–R is in good agreement with the experiments, and the values for Al^+–He and Al^+–Ar computed by a similar statistical method are also in good agreement with the experimental results, while Al^+–Ne resulted in a significant discrepancy. (auth)

15676 LOW-ENERGY ELECTRON SCATTERING BY ATOMIC CARBON. Thomas, L.D.; Nesbet, R.K. (IBM Research Laboratory, San Jose, California 95193). Phys. Rev. A 12: No. 6, 2378-2382 (Dec 1975).

Matrix variational calculations of electron scattering by atomic C have been carried out, including target atom configurations $2s^22p^2$, $2s2p^3$, and $2p^4$ and all possible single virtual excitations of the $2p$ orbital. Total and differential elastic and inelastic cross sections are reported for energies below the first $n = 3$ excitation threshold. In the lowest energy range, scattering is dominated by a $^2P^o$ shape resonance. The position of this resonance, which is sensitive to small differences of electronic correlation energy, is parametrized by a net correlation energy parameter whose value is chosen to place the $^2D^o$ state of C^- at its experimental position, just below the neutral ground state. Estimates are given of the rate constants for deactivation of the ^1D, ^1S, and $^5S^o$ states by thermal electrons. (auth)

15677 LOW-ENERGY ELECTRON SCATTERING BY ATOMIC NITROGEN. Thomas, L.D.; Nesbet, R.K. (IBM Research Laboratory, San Jose, California 95193). Phys. Rev. A 12: No. 6, 2369-2377 (Dec 1975).

Matrix variational calculations of electron scattering by atomic N have been carried out, including target configurations $2s^22p^3$, $2s2p^4$, $2p^5$, and all possible single virtual excitations of $2s$ and $2p$ orbitals. Total and differential elastic and inelastic cross sections are reported for energies below the first $n = 3$ excitation threshold. In the lowest energy range, scattering is dominated by a ^3P shape resonance whose exact location is sensitive to small differences of electronic correlation energy. Results were obtained for several values of a net correlation energy parameter that produces a systematic shift in the resonance position. Detailed cross sections are given for the value of this parameter in best accord with existing low-energy scattering data. A $^3P^o$ shape resonance is found in the $^2D^o \rightarrow {}^2P^o$ excitation cross section just below the $n = 3$ threshold. Estimates are given of the rate constants for deactivation of the $^2D^o$ and $^2P^o$ states by thermal electrons. The locations of the ^1D and ^1S states of N^-, which do not couple to continuum states, are estimated. (auth)

15678 PSEUDO-BOUND-STATE STUDY OF LOW-ENERGY ELECTRON-MOLECULE COLLISIONS: ELASTIC e-H_2 SCATTERING. Morrison, M.A.; Lane, N.F. (Physics Department, Rice University, Houston, Texas 77001). Phys. Rev. A 12: No. 6, 2361-2368 (Dec 1975).

A study of the low-energy elastic e-H_2 scattering information contained in multiconfiguration variational wave functions for a low-lying (positive) energy of the H_2^- system is described. The wave function is calculated using standard bound-state techniques, employing the modified valence-bond method with a basis set of Slater-type orbitals, and from it are obtained starting values at moderate electron-molecule separations for a simple single-channel scattering calculation, which is carried out beyond the region where exchange and coupling of partial waves are thought to be important. Results are presented for s_g elastic scattering for incident-electron energies ≤ 10 eV in the static-exchange approximation with polarization included by means of an adiabatic polarization potential. The study shows that the standard H_3 variational function does indeed provide a good approximation to the elastic scattering wave function in the region close to the molecule, but that care must be taken in choosing the basis set. Comparisons are made with other more traditional calculations. (auth)

15679 CROSS SECTIONS AND THRESHOLD EFFECTS FOR ELECTRON-IMPACT EXCITATION OF THE $(2s^2)$ ^1S AND $(2s2p)$ ^3P STATES OF HELIUM. Spence, D. (Argonne National Laboratory, Argonne, Illinois 60439). Phys. Rev. A 12: No. 6, 2353-2360 (Dec 1975).

The energy and intensity of scattered electrons resulting from excitation of the $(2s^2)$ ^1S and $(2s2p)$ ^3P autoionizing states of helium have been measured as a function of incident electron energy. For incident energies only slightly higher than the threshold for $(2s^2)$ ^1S excitation, post-collision interactions between the scattered and ejected electrons cause the slowly moving *scattered* electron to *lose* an amount of energy proportional to $E_{ex}^{-1.25 \pm 0.05}$ (where E_{ex} is the energy the scattered electron would have had in the absence of a post-collision interaction). This energy dependence compares well with an energy *gain* of the *ejected* electron proportional to $E_{ex}^{-1.2}$, obtained by previous workers. Measurements of the intensity of scattered electrons show that both ^1S and ^3P total cross sections peak at threshold and have magnitudes about (2.0 and 4.0) $\times 10^{-20}$ cm^2, respectively, then rise to broad maxima of magnitudes about (2.5 and 5) $\times 10^{-20}$ cm^2 about 4.0 eV above their thresholds. A subsidiary peak at 59.0 eV in the ^3P cross section is attributed to decay of the previously unidentified $(2s2p^2)$ ^2S He^- state into the ^3P channel. The magnitude, energy, and width of this resonant structure in the ^3P channel agrees with theoretical predictions. (auth)

15680 LOW-ENERGY ELECTRON SCATTERING FROM CO. Chandra, N. (Theoretical Studies Group, National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Maryland 20771). Phys. Rev. A 12: No. 6, 2342-2352 (Dec 1975).

The scattering of electrons from carbon monoxide has been studied in the framework of a previously proposed pseudopotential method. It is found that the single-center expansion of the continuum electron orbital about the center of mass of the molecule is very well converged when the two noncoincident nuclear singularities and the nonlocal exchange interactions are properly taken into account in the scattering equations. An analytical proof has been given to show that unlike the total cross section, the momentum-transfer cross section in the fixed-nuclei approximation is finite even for polar molecules. The calculated results of the momentum-transfer cross section for e^--CO scattering in the energy range between 0.1 and 10.0 eV are in good accord with the experimental measurements. (auth)

15681 TEMPERATURE DEPENDENCE OF THE RELAXATION TIME IN DILUTE ^{3}He GAS: AN INVESTIGATION OF THE He-He POTENTIAL. Chapman, R. (Department of Physics, University of British Columbia, Vancouver, British Columbia V6T 1W5, Canada). Phys. Rev. A 12: No. 6, 2333-2341 (Dec 1975).

The first measurements of the temperature dependence of the intrinsic dipolar relaxation time T_{1B} due to binary collisions in dilute ^{3}He gas are reported. Experimental conditions sufficiently pure to observe T_{1B} were obtained by coating bare Pyrex sample cells with clean neon gas. The experiments were performed at low temperatures (1.7 to 19.0 K) where the colliding atoms have correspondingly low energy, so the effect of the long-range attractive forces is strongly felt and the measurements are sensitive to the depth and nature of the helium attractive well. Calculations of T_{1B} using the best available helium potentials have been fitted to the experimental results to test the parameters which describe the potential. The data favor a potential of the Bruch-McGee form, but having a slightly deeper attractive well of 11.5 K. (auth)

15682 MOLECULAR-ORBITAL THEORY FOR *K*-VACANCY SHARING IN ATOMIC COLLISIONS. Taulbjerg, K.; Vaaben, J.; Fastrup, B. (Institute of Physics, University of Aarhus, DK 8000 Aarhus C, Denmark). Phys. Rev. A 12: No. 6, 2325-2332 (Dec 1975).

We have calculated the projectile and target *K*-excitation cross sections and their ratio for a series of ion-target combinations using a basis of exact molecular eigenstates for a model system of one electron in the field of two effective nuclear charges. Except for very asymmetric high-velocity collisions, close agreement is found with Meyerhof's formula, which is based on an atomic two-state expansion. In this range, Meyerhof's formula may be considered an analytical fit to our *ab initio* results. We indicate that the apparent accuracy of Meyerhof's formula is due to mutual cancellation of effects arising from approximations and model assumptions used in his deduction of the cross-section ratio. The significant deviation found at high velocities results from interference between the coupling processes that govern *K*-vacancy production. This possibility was ruled out in Meyerhof's theory. (auth)

15683 ELASTIC SCATTERING OF ELECTRONS BY OXYGEN AND NITROGEN AT INTERMEDIATE ENERGIES. Blaha, M. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742); Davis, J. Phys. Rev. A 12: No. 6, 2319-2324 (Dec 1975).

The total and differential elastic scattering cross section of electrons by atomic oxygen and nitrogen is calculated for energies between 1 and 500 eV in the distorted-wave (DW) approximation. The DW method has been modified by the inclusion of a polarization potential with an adjustable cutoff parameter which is determined variationally. The relative importance of polarization and exchange effects are compared for a variety of energies. These calculations show that the DW method is reliable above about 10 eV and with the inclusion of the polarization potential improves the estimates even below this energy. (auth)

15684 SCATTERING OF ELECTRONS BY HYDROGEN ATOMS AT INTERMEDIATE ENERGIES: ELASTIC DIFFERENTIAL CROSS SECTIONS FROM 10 TO 30 eV. Callaway, J. (Department of Mathematics, Imperial College, London SW 7 2RH, England); Williams, J.F. Phys. Rev. A 12: No. 6, 2312-2318 (Dec 1975).

The elastic scattering amplitude obtained from an open pseudostate calculation employing the algebraic variational method for partial waves of angular momentum $0 < L < 3$, is combined with phase shifts obtained in the extended polarization approximation for $4 < L < 99$ to obtain elastic differential cross sections for electron-hydrogen scattering for electron energies in the range 10–30 eV. Elastic angular distributions have been measured using a crossed-electron modulated-atom-beam method and absolute cross-section values determined using a phase-shift analysis method. The measurements include energies from 10 to 30 eV and angles from 10° to 140° with estimated experimental error limits of ±17%. Within these error limits they are in agreement with the theoretical predictions except at 20 to 26 eV for angles greater than or equal to 120°, where the theoretical values are significantly higher than allowed by these error limits. (auth)

15685 COMMENT ON "SEMICLASSICAL TREATMENT OF VIBRATIONAL-TRANSLATIONAL ENERGY TRANSFER IN THE NEAR-ADIABATIC APPROXIMATION". Cady, W.A. (Department of Chemistry, Indiana-Purdue University at Indianapolis, Indianapolis, Indiana 46205); Clark, A.P.; Dickinson, A.S. J. Chem. Phys. 63: No. 12, 5505-5506 (15 Dec 1975).

Recently [W. A. Cady, J. Chem. Phys. 61, 1214 (1974)], a near-adiabatic (perturbed stationary states) approximation was used in an investigation of the collinear vibrational excitation of a harmonic oscillator. This approximation reduced the problem to that of obtaining transition probabilities for a harmonic oscillator with time-dependent forcing function. Cady derived an apparently exact solution for this problem. It is shown that this solution is not exact but that the solution results from making a further adiabatic approximation and give a derivation that clearly shows the adiabatic character of this further approximation. (auth)

15686 EIKONAL EXCHANGE AMPLITUDES AND THE INCLUSION OF EXCHANGE IN ELASTIC (*e*, H) SCATTERING. Madan, R.N. (Department of Physics, North Carolina A&T State University, Greensboro, North Carolina 27411). Phys. Rev. A 12: No. 6, 2631-2634 (Dec 1975).

The six-dimensional integral involved in the eikonal (*e*, H) rearrangement amplitudes is reduced to a two-dimensional form. When the Glauber condition $\vec{q}\cdot\vec{z} = 0$ is imposed, there is no post-prior discrepancy in the elastic rearrangement amplitudes. The Ochkur reduction of the rearrangement amplitudes is obtained in a closed form. Application is made to the inclusion of the exchange effect in the Glauber calculation of elastic (*e*, H) scattering at 50 eV. (auth)

15687 DOPPLER SHIFT OF CONTINUUM X RAYS FROM HEAVY-ION COLLISIONS. Meyerhof, W.E.; Saylor, T.K. (Department of Physics, Stanford University, Stanford, California 94305); Anholt, R. Phys. Rev. A 12: No. 6, 2641-2643 (Dec 1975).

The continuum *K* x-ray spectrum from 200-MeV Kr + Zr has been found to undergo a Doppler shift with an effective Doppler velocity equal to $(0.92 \pm 0.03)\ v_{ci}$, where v_{ci} is equal to the center-of-mass velocity of the intermediate Kr + Zr molecule, corresponding to the incident projectile velocity. If the x rays are indeed generated by quasimolecular processes, the expected Doppler velocity is $0.90 v_{ci}$, taking into account the slowing down of the projectile in the target. The anisotropy of the continuum spectrum in the c.m. system is derived. (auth)

15688 INTENSITY DEPENDENCE OF THE COLLISION FREQUENCY. Choudhury, B.J. (Physics Department, University of Manitoba, Winnipeg, Canada). Phys. Rev. A 12: No. 6, 2644-2646 (Dec 1975).

Using the formulation of Seely and Harris, the intensity dependence of the collision frequency has been studied numerically for both Coulomb and screened Coulomb potentials. The results are discussed in the context of the laser-induced gas breakdown. (auth)

Atomic Theory

Refer also to abstract 16038.

15689 (LYCEN-7537) CLEBSCH–GORDAN COEFFICIENTS ADAPTED TO THE CUBICAL, TETRAGONAL, AND DIGONAL DOUBLE GROUPS. Kibler, M. R.; Guichon, P. A. M. (Lyon-1 Univ., 69–Villeurbanne (France). Inst. de Physique Nucleaire). May 1975. 45p. Dep. NTIS (US Sales Only) $4.00.

Some basic considerations on the Clebsch–Gordan coefficients adapted to a chain of sub-groups of the universal covering SU_2 of the proper rotation group SO_3 are reviewed. Extensive tables of Clebsch–Gordan coefficients adapted to a chain isomorphic to $SU_2 \supset O' \supset D_4' \supset D_2'$ are presented for consultation. These coefficients are useful in various fields of molecular spectroscopy, particularly in the ligand field theory. To the best of knowledge, the tables listed constitute the most extensive tabulation of coupling coefficients of molecular interest. (auth)

15690 THRESHOLD BEHAVIOR OF BOUND-BOUND AND BOUND-FREE PHOTOABSORPTION FOR THE SCREENED COULOMB POTENTIALS. Shore, B. W. (Univ. of California, Livermore). J. Phys., B (London); 8: No. 12, 2023-2040(1975).

Computations of bound–bound and bound–free transition strengths for a particle bound by a screened Coulomb (Debye) potential show that near the ionization limit transition strengths differ markedly from hydrogenic values: oscillator strengths of Rydberg series diminish more rapidly than the hydrogenic n^{-3} decrement and photoionization cross sections are zero at threshold. Sharp near-threshold photoionization resonances occur for appropriate Debye lengths. These effects are examined and illustrative computations are presented. (auth)

15691 MULTIPHOTON IONIZATION OF ATOMS. Mainfray, G.; Manus, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91–Gif-sur-Yvette (France). Service de Physique Atomique). Bull. Inf. Sci. Tech. (Paris); No. 204, 5-16(Jun 1975). (In French)

The most important parameters which govern the multiphoton ionization process of atoms, namely the atomic bound states, the frequency, temporal coherence and polarization of the laser light are investigated. Moreover, multiphoton spectroscopy is an application of multiphoton transitions in atomic physics, and allows the determination of the energy of highly excited levels of atoms. (FR)

15692 THEORY OF K-MM RADIATIVE-AUGER TRANSITIONS. Baptista, G. B. Ithaca, NY; Cornell Univ. (1975). 98p. University Microfilms Order No. 75-22,964.

Thesis (Ph. D.).

Presently available calculations of transition probabilities for radiative-Auger and double-Auger processes are based on shake-off theory. In this theory, such processes are thought of as being due to electron core rearrangement associated with de-excitation of an inner shell vacancy. It is suggested that radiative-Auger processes result from the interaction of two

electrons with one another and the radiation field in the presence of an inner shell vacancy, while double-Auger processes result from the interaction of an electron with two electrons in the presence of a similar vacancy. Expressions for the transition probabilities of these processes are derived in second order time dependent perturbation theory. The interaction is taken as the sum of the Coulomb interaction and electron-field interaction of the electrons involved. This approach allows calculation of the detailed photon or electron energy distribution resulting from such processes, as well as the relative and absolute transition rates involved. As a specific example of this approach the transition probability for the K-MM radiative-Auger effect in argon is calculated and compared with available experimental data. Scaled Thomas-Fermi wavefunctions are used to calculate the total transition probability which is found to be 2.68×10^{-4} eV/Dirac. In addition, the spectral distribution of emitted photons is obtained, and agreement both in magnitude and with the general features of the experimental data is excellent. (Diss. Abstr. Int., B)

15693 PRIMEVAL BLACK HOLES AND GALAXY FORMATION. Meszaros, P. (Cambridge Univ. (UK). Inst. of Astronomy). Astron. Astrophys.; 38: No. 1, 5-13(Jan 1975).

1 fig.; 1 tab.; with refs.

We present a scheme of galaxy formation, based on the hypothesis that a certain fraction of the mass of the early universe is in the form of black holes. It is argued that the black hole mass should be approximately 1 $M_{\odot}$ and it is shown that random statistical fluctuations in their number cause density fluctuations which grow in time. The advantage over the usual baryon fluctuations are twofold: $\delta N/N$ is much larger for black holes than for baryons, and the black holes are not electromagnetically coupled to the radiation field, as the baryons are. One is thus able to achieve galaxy and cluster formation at the right redshifts, and at the same time the black holes would account for the recently proposed massive halos of galaxies, and for the hidden mass in clusters required by virial theorem arguments. The number of free parameters in this theory is less than, or at most equal to, that in the current "primeval fluctuations" theory, while the physical picture that is achieved seems more satisfactory, from a self-consistency point of view. (DE)

15694 SPIN PROJECTED EXTENDED HARTREE-FOCK CALCULATIONS BY DIRECT MINIMIZATION OF THE ENERGY FUNCTIONAL. Rosenberg, M.; Martino, F. (Physics Department, City College of the City University of New York, New York, New York 10031). J. Chem. Phys. 63: No. 12, 5354-5361 (15 Dec 1975).

A practicable SEHF scheme for the treatment of electron correlation in systems for which large scale configuration interaction calculations are prohibitive is presented. A study is made of the electronic structures to which the SEHF method may be most profitably applied. In order to illustrate this study and to provide a numerical demonstration of the minimization techniques *ab initio* SEHF calculations on a number of ten electron systems are reported. These calculations were performed for the singlet ground states of Ne, HF, H_2O, NH_3, CH_4, and cyclic H_{10}. (auth)

15695 UNIFORM SEMICLASSICAL APPROXIMATION TO THE ELECTRON DENSITY DISTRIBUTION. Lee, S.Y.; Light, J.C. (The Department of Chemistry and The James Franck Institute, The University of Chicago, Chicago, Illinois 60637). J. Chem. Phys. 63: No. 12, 5274-5282 (15 Dec 1975).

The single particle reduced density matrices for fermions in a linear potential in one and three dimensions are derived. An idempotent reduced density matrix for a nonuniform field with a single turning point is obtained. The density expression contains the contributions from the direct path and the path with one turning point. When applied to a potential well the corrections from the long-time paths are taken from the theory of Light and Yuan. Only classical quantities of momentum, time, and action enter in the final expression. The density distribution for the nonclassical region is more accurate than that given by the formula of Light and Yuan. (auth)

15696 HEISENBERG-PICTURE OPERATOR PERTURBATION THEORY. Ackerhalt, J.R. (Department of Physics and Astronomy, University of Rochester, Rochester, New York 14627); Rzążewski, K. Phys. Rev. A 12: No. 6, 2549-2567 Dec 1975).

We develop a systematic method of operator perturbation theory in the Heisenberg picture, which is the formal analog of time-independent stationary-state perturbation theory in the Schrödinger picture. However, we use the eigenoperators and operator eigenfrequencies to calculate the time evolution of the dynamical variables of interest. The spectrum of the unperturbed Hamiltonian is assumed to be discrete. The method is especially well-suited for treating systems where the unperturbed Hamiltonian represents noninteracting fermions and/or bosons, and therefore, we illustrate the method using the exactly solvable model of Jaynes and Cummings: a single two-level atom interacting with a single quantized field mode. The time evolution of these operator solutions is shown to be unitary order by order in powers of the interaction strength. We find that the time evolution of exact operator solutions is well approximated for significantly longer times by the time evolution of this method's operator solutions than by the time evolution of the same operator solutions calculated using the Dyson expansion. We also demonstrate that time-dependent operator solutions are very convenient for computing quantities such as correlation functions. (auth)

15697 AN EQUATIONS OF MOTION APPROACH FOR OPEN SHELL SYSTEMS. Yeager, D.L.; McKoy, V. (Arthur Amos Noyes Laboratory of Chemical Physics, California Institute of Technology, Pasadena, California 91125). J. Chem. Phys. 63: No. 11, 4861-4869 (1 Dec 1975).

A straightforward scheme is developed for extending the equations of motion formalism to systems with simple open shell ground states. Equations for open shell random phase approximation (RPA) are given for the cases of one electron outside of a closed shell in a nondegenerate molecular orbital and for the triplet ground state with two electrons outside of a closed shell in degenerate molecular orbitals. Applications to other open shells and extension of the open shell EOM to higher orders are both straightforward. Results for the open shell RPA for lithium atom and oxygen molecule are given. (auth)

15698 NUMERICAL-DIFFERENTIATION APPROACH FOR THE GROUND STATE OF THE He ATOM. Shoucri, R.M.; Darling, B.T. (Département de Physique, Université Laval, Québec, G1K 7P4, Canada). Phys. Rev. A 12: No. 6, 2272-2280 (Dec 1975).

The method of numerical differentiation is applied to solve the coupled set of ordinary differential equations for a three-body system derived in the previous paper. This is done for the ground state of the He atom. The matching of the forward and backward numerical solutions of the coupled system of differential equations is achieved by repeated applications of Newton's correction method. The matching of up to 16 coupled curves is carried out successfully, but the results obtained show that a very large number of coupled terms are required to obtain a good convergence of the ground-state energy. (auth)

15699 DEFORMED HARTREE-FOCK SOLUTIONS FOR ATOMS. III. CONVERGENT ITERATIVE PROCESS AND RESULTS FOR O^{--}. Delgado-Barrio, G.; Prat, R.F. (Laboratoire de Photophysique Moléculaire, Bât. 213 Université Paris-Sud, 91405-Orsay, France). Phys. Rev. A 12: No. 6, 2288-2297 (Dec 1975).

We present a systematic study of self-consistent symmetries (SCS) for the ten-electron atom O^{--} in an $s + p$ basis. The investigation of each SCS required a detailed study of the character of the iterative process. Convergency is ensured by a minimum-energy selection principle. Six deformed Hartree-Fock solutions for O^{--} have been obtained. (auth)

15700 EXACT SOLUTION OF A REALISTIC MODEL FOR TWO-PHOTON IONIZATION. Beers, B.L.; Armstrong, L. Jr. (Department of Physics, The Johns Hopkins University, Baltimore, Maryland 21218). Phys. Rev. A 12: No. 6, 2447-2454 (Dec 1975).

A realistic model for resonant two-photon ionization of an atom is developed which can be solved exactly to give the ionization probability as a function of time, photon intensity, and a few atomic parameters. The exact solutions are compared to various commonly used perturbation results in order to ascertain the regions of validity of the perturbation calculations. It is shown that there are combinations of the parameters for which ionization rates cannot accurately describe the correct results, and that one commonly used perturbation development is not generally applicable to resonant two-photon ionization. Extension of the model to $(n + m)$ -photon ionization having an m-photon resonance is discussed. The model is applied to two- and three-photon ionization in Cs. (auth)

PHYSICS (ELECTROFLUID AND MAGNETOFLUID)

Refer also to abstracts 15702, 15704, 15706, 15888, and 16079.

15701 (BNL-tr-614) FINITE-AMPLITUDE WAVES IN A SUPERCONDUCTING COAXIAL LINE. Kiselev, M. I. Translated by S. J. Amoretty from Zh. Tekh. Fiz.; 45: No. 2, 382-385(1975). 9p. Dep. NTIS $4.50.

The propagation of deformations and perturbations of the magnetic field in a superconducting transmission line consisting of a coaxial system of elastic conductors cooled by streams of cryogenic liquid is treated in the hydrodynamic approximation. (auth)

15702 (N-75-19577) NEW FORMULATION OF THE CONSERVATION EQUATIONS OF FLUID DYNAMICS. Vinokur, M. National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center). Aug 1974. 27p. (NASA-TM-X-62415; A-5931). NTIS $3.75.

The computation of time-dependent flows has inspired a new, higher-dimensional formulation of the conservation equations of fluid dynamics in which time is treated as a fourth coordinate. The formulation is derived for a constant-density flow, and then extended to a variable-density flow by introducing a fifth, fictitious coordinate. This new coordinate can also act as a source coordinate, so that external source terms can be included. The analysis is carried out for both incompressible, stratified flow and compressible equilibrium flow. The results are then extended to non-equilibrium and magnetohydrodynamic flows. Several applications of the new formulation to the computation of time-dependent flows are discussed. (auth)

15703 (ORNL-tr-4059) STATISTICAL MODELS IN TURBULENCE THEORY. Novikov, E. A. [nd]. Translation by M. Gerrard of Statisticheskie Modeli v Teorii Turbulentnosti, Akademiya Nauk SSSR, Moscow, 1969. 9p. Dep. NTIS $4.25.

Similarity considerations are used, but basic effort is directed toward obtaining results which cannot be described by one of the dimension relations. A model is used based on the Navier–Stokes equations having a purely statistical nature. The similarity concept itself is somewhat broadened—a scale similarity is introduced. Problems describing turbulent flow in terms of the characteristic functional and finite measured distributions are also considered. (auth)

15704 (TID-3356) MAGNETOHYDRODYNAMICS POWER GENERATION AND THEORY. A BIBLIOGRAPHY. (Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center). Nov 1975. 875p. Dep. NTIS $13.60.

A major portion of the scientific and technical information published on this subject since 1957 has been cataloged, indexed, and stored in machine-readable form. The compilation includes 8539 citations of foreign and domestic research reports, journal articles, patents, conference proceedings, and books. The references are arranged in broad categories and are made up of complete bibliographic citations. (BJG)

15705 MAGNETOHYDRODYNAMIC FLOW BETWEEN TWO PARALLEL POROUS WALLS WITH TIME-VARYING SUCTION. Mishra, S. P.; Mohapatra, P. (Utkal Univ., Bhubaneswar, India). Rev. Roum. Phys.; 20: No. 4, 321-331(1975).

Unsteady motion of an electrically conducting liquid between two parallel porous plates has been considered when there is time-varying suction at the plates. There is also a transverse magnetic field at the plates. The induced magnetic field has been neglected. The lower plate is at rest and the upper plate moves periodically with a constant mean. The suction velocity at the plate varies periodically with a constant non-zero mean. The flow phenomenon has been characterized by the parameters S (magnetic parameter), ω (frequency parameter) and A (variable suction parameter) and the role of these parameters on the flow characterisitics has been studied. (auth)

15706 ELECTRIC FIELDS IN AN ANISOTROPICALLY CONDUCTING PLASMA WITH INHOMOGENEOUS CYLINDRICAL BODIES. Grigoriadi, A. K.; Emets, Yu. P. (Inst. of Electrodynamics, Kiev). High Temp. (USSR) (Engl. Transl.); 12: No. 5, 972-975(1974).

Translated from Teplofiz. Vys. Temp.; 12: No. 5, 1108-1111 (1974).

In the general case of a low-temperature plasma in an electric field a spatial inhomogeneity occurs for various reasons. The properties of electric fields in such a plasma and its effective parameters are determined by the structure of the inhomogeneities and the fluctuations in the properties of the medium. In a strong magnetic field, weak inhomogeneities in plasma conductivity can produce appreciable perturbations of the fields and marked changes in its properties. A plasma in crossed homogeneous fields is considered which contains inhomogeneous cylinders of elliptical cross section with axes in the direction of the magnetic field. This case illustrates a two-dimensional picture of the inhomogeneities often found in a strong magnetic field. Interactions between the inhomogeneities can be neglected. Under these assumptions the field in the neighborhood of the inhomogeneity and the average electrical characteristics of the plasma in the magnetic field are calculated. (RWR)

15707 UNIVERSAL STABILITY OF THERMO-DIFFUSIVE-MAGNETO-HYDRODYNAMICS. Ahmadi, G. (Pahlavi Univ., Shiraz, Iran). Energy Convers.; 15: No. 1/2, 35-38(1975).

Criteria for universal stability of the unsteady motion of an incompressible, electrically conducting Boussinesq fluid with heat and mass transfer in the presence of an arbitrary magnetic field and in an arbitrary time dependent domain are established. The interaction between the flow field and the magnetic field is manifested through the Lorentz force and the coupling between the flow and temperature and concentration fields arises through the Boussinesq equation of state. The stability method employed is an energy technique due to James Serrin. Certain uniqueness theorems for the unsteady and steady flows of thermo-diffusive solution in the presence of a magnetic field are also established. The theorems established for the stability and uniqueness are universal in the sense that they may be applied to any geometry of bounded domains and any distribution of the basic field variables. (auth)

15708 SECOND-ORDER RAMAN SCATTERING FROM SUPERFLUID HELIUM. Carver, T. R. (Princeton Univ., NJ); Pike, E. R.; Vaughan, J. M. J. Phys., C (London); 8: No. 18, L384-L387(21 Sep 1975).

The second-order Raman scattering spectrum of superfluid helium has been examined with a grating spectrometer providing a resolution of 1 K. Extensive studies at SVP in the region of the two-roton peak have not revealed the fine structure recently reported by other authors employing lower resolution. Possible reasons for this discrepancy are outlined. Measurements at higher pressures up to 15 atm show good agreement of the roton pressure shift with neutron scattering data. (auth)

15709 RINGING-DOWN OF THE "WALL-PINNED" MODE IN ^{3}He-*B* AS A TEST OF THEORIES OF SPIN RELAXATION. Leggett, A.J. (Department of Physics, University of Illinois, Urbana, Illinois 61801). Phys. Rev. Lett. 35: No. 17, 1178-1180 (27 Oct 1975)

The decay in time of the frequency of the so-called "wall-pinned" mode in the nuclear resonance of ^{3}He-*B* is shown to provide a test of a previously developed theory of spin relaxation and to give a numerical value of a previously unknown parameter of the normal phase. (auth)

15710 RELAXATION OF THE WALL-PINNED MAGNETIZATION RINGING MODE IN SUPERFLUID ^{3}He-*B*. Webb, R.A.; Sager, R.E.; Wheatley, J.C. (Department of Physics, University of California at San Diego, La Jolla, California 92037). Phys. Rev. Lett. 35: No. 17, 1164-1166 (27 Oct 1975).

Observations of the wall-pinned mode in ^{3}He-*B* allow new magnetic relaxation phenomena to be studied. Excepting the quantitative value of the zero-time ringing frequency, comparison of experiment with theory is satisfactory, including a linear dependence of the square of the ringing period on time and a sqaure-root singularity near T_c in the relaxation parameter. (auth)

PHYSICS (HIGH-ENERGY)

Particle Interactions and Properties (Experimental)

Refer also to abstract 15756.

Electromagnetic

15711 (DESY-75/40) REVIEW OF ELECTROPRODUCTION OF FINAL STATES. Wolf, G. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Oct 1975. 66p. (CONF-750855-14). Dep. NTIS (US Sales Only) $4.50.

From international symposium on lepton and photon interactions at high energies; Stanford, California, USA (21 Aug 1975).

A review is presented covering exclusive final states as well as inclusive hadron spectra produced in electron or muon-nucleon scattering. Only new experimental data are discussed in general. (JFP)

15712 (DESY-F-1-75/04) LITERATURE ON PHOTOPRODUCTION EXPERIMENTS. Joos, P. (comp.). (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Oct 1975. 73p. Dep. NTIS (US Sales Only) $4.50.

A bibliography on photoproduction experiments is presented. (JFP)

15713 (LUSY-7502) SOME DIFFERENTIAL CROSS SECTIONS FOR THE PHOTOPRODUCTION OF π^0-MESONS FROM HYDROGEN. Dougan, P.; Kivikas, T.; Lugner, K.; Ramsay, V.; Stiefler, W. (Lund Univ. (Sweden). Fysiska Institutionen). Feb 1975. 66p. Dep. NTIS (US Sales Only) $4.50.

The results of measurements of cross sections for the photoproduction of neutral π-mesons from hydrogen in the pion c.m. angular range 60 to 125° are reported. A full discussion of the experimental method is given. (auth)

15714 PHOTOPRODUCTION OF NEGATIVE PIONS ON A POLARIZED NEUTRON TARGET IN THE RESONANCE REGION. Althoff, K. H.; Beckschulze, H.; Conrad, R.; DeWire, J.; Herr, H.; Hilger, E.; Kadansky, V.; Kaul, O.; Menze, D.; Meyer, W. (Bonn Univ. (F. R. Germany). Physikalisches Inst.). Nucl. Phys., B; 96: No. 3, 497-508(29 Sep 1975).

At the Bonn 2.5 GeV electron synchrotron the first measurements of the target asymmetry for the reaction $\gamma + n$ (spin up) $\rightarrow \pi^- + p$ have been performed. The negative pions were detected in a magnetic spectrometer at a constant pion c.m. angle of 40° and photon energies between 0.45 GeV and 2.0 GeV. Deuterated butanol was used as target material. The polarization of the deuteron was about 16%. The results show a significant difference from the previously measured π^+ asymmetry. (NL)

15715 QUANTUM NUMBERS AND DECAY WIDTHS OF THE ψ (3684). Lüth, V.; Boyarski, A.M.; Lynch, H.L.; Breidenbach, M.; Bulos, F.; Feldman, G.J.; Fryberger, D.; Hanson, G.; Hartill, D.L.; Jean-Marie, B.; Larsen, R.R.; Lüke, D.; Morehouse, C.C.; Paterson, J.M.; Perl, M.L.; Pun, T.P.; Rapidis, P.; Richter, B.; Schwitters, R.F.; Tanenbaum, W.; Vannucci, F. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305); Abrams, G.S.; Chinowsky, W.; Friedberg, C.E.; Goldhaber, G.; Kadyk, J.A.; Litke, A.M.; Lulu, B.A.; Pierre, F.M.; Sadoulet, B.; Trilling, G.H.; Whitaker, J.S.; Winkelmann, F.C.; Wiss, J.E. Phys. Rev. Lett. 35: No. 17, 1124-1126 (27 Oct 1975).

Cross sections for e^+e^-→hadrons, e^+e^-, and $\mu^+\mu^-$ near 3684 MeV are presented. The ψ (3684) resonance is established as having the assignment $J^{PC} = 1^{--}$. The mass is 3684 ± 5 MeV. The partial width for decay to electrons is $\Gamma_e = 2.1 \pm 0.3$ keV and the total width is $\Gamma = 228 \pm 56$ keV. (auth)

15716 OBSERVATION OF AN INTERMEDIATE STATE IN ψ (3684) RADIATIVE CASCADE DECAY. Tanenbaum, W.; Whitaker, J.S.; Abrams, G.S.; Boyarski, A.M.; Breidenbach, M.; Bulos, F.; Chinowsky, W.; Feldman, G.J.; Friedberg, C.E.; Fryberger, D.; Goldhaber, G.; Hanson, G.; Hartill, D.L.; Jean-Marie, B.; Kadyk, J.A.; Larsen, R.R.; Litke, A.M.; Lüke, D.; Lulu, B.A.; Lüth, V.; Lynch, H.L.; Morehouse, C.C.; Paterson, J.M.; Perl, M.L.; Pierre, F.M.; Pun, T.P.; Rapidis, P.; Richter, B.; Sadoulet, B.; Schwitters, R.F.; Trilling, G.H.; Vannucci, F.; Winkelmann, F.C.; Wiss, J.E. (Lawrence Berkeley Laboratory and Department of Physics, University of California, Berkeley, California 94720). Phys. Rev. Lett. 35: No. 20, 1323-1326 (17 Nov 1975).

We present evidence for the existence of an intermediate state observed in the decay sequence ψ (3684) →ψ (3095) $\gamma\gamma$. The mass of the state is either 3500 ± 10 or 3270 ± 10 MeV. The branching fraction of the sequence is (3.6 ± 0.7) %. (auth)

15717 AZIMUTHAL ASYMMETRY IN INCLUSIVE HADRON PRODUCTION BY e^+e^- ANNIHILATION. Schwitters, R.F.; Boyarski, A.M.; Breidenbach, M.; Bulos, F.; Feldman, G.J.; Hanson, G.; Hartill, D.L.; Jean-Marie, B.; Larsen, R.R.; Lüke, D.; Lüth, V.; Lynch, H.L.; Morehouse, C.C.; Paterson, J.M.; Perl, M.L.; Pun, T.P.; Rapidis, P.; Richter, B.; Tanenbaum, W.; Vannucci, F. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305); Pierre, F.M.; Abrams, G.S.; Chinowsky, W.; Friedberg, C.E.; Goldhaber, G.; Kadyk, J.A.; Litke, A.M.; Lulu, B.A.; Sadoulet, B.; Trilling, G.H.; Whitaker, J.S.; Winkelmann, F.C.; Wiss, J.E. Phys. Rev. Lett. 35: No. 20, 1320-1322 (17 Nov 1975).

We have observed an azimuthal asymmetry in inclusive hadron production by e^+e^- annihilation at the center-of-mass energy $\sqrt{s} = 7.4$ GeV. The asymmetry is caused by the polarization of the circulating beams in the storage ring and allows separate determination of the transverse and longitudinal structure functions. We find that transverse production dominates for $x > 0.2$ where x is the scaling variable $2p/\sqrt{s}$. (auth)

15718 ELECTROPRODUCTION OF SINGLE PIONS WITH LARGE TRANSVERSE MOMENTA. Browman, A.; Hanson, K.M.; Holmes, S.D.; Kline, R.V.; Larson, D.; Pipkin, F.M.; Raither, S.W.; Silverman, A. (Laboratory for Nuclear Studies, Cornell University, Ithaca, New York 14850). Phys. Rev. Lett. 35: No. 20, 1313-1316 (17 Nov 1975).

We report measurements of the electroproduction reaction $ep \rightarrow e\pi^+ n$ for pions produced between 60 and 90° in the virtual-photon-proton center-of-mass system. The cross section is studied as a function of the center-of-mass energy, W, and the square of the virtual-photon mass, $-Q^2$, in the region $1.2\ \text{GeV} \leq W \leq 3.0$ GeV, $1.2\ \text{GeV}^2 \leq Q^2 \leq 4.4\ \text{GeV}^2$. The data show a strong W dependence in accord with simple quark-model predictions but exhibit a Q^2 dependence which is difficult to explain in the context of such a model. (auth)

15719 ELECTRON SCATTERING AT 4° WITH ENERGIES OF 4.5-20 GeV. Stein, S.; Atwood, W.B.; Bloom, E.D.; Cottrell, R.L.A.; DeStaebler, H.; Jordan, C.L.; Piel, H.G.; Prescott, C.Y.; Siemann, R.; Taylor, R.E. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). Phys. Rev. D 12: No. 7, 1884-1919 (1 Oct 1975).

This paper presents the results of the analysis of a single-arm inelastic-electron-scattering experiment at an angle of 4°. We present data on the turnon of scaling in the low-q^2 region $0.1 < q^2 < 1.8$, the neutron-proton comparison at large values of the scaling variable ω, resonance excitation, and the shadowing in scattering from heavy nuclei. (auth)

15720 COMMENTS ON THE REPORTED OBSERVATION OF A MONOPOLE. Friedlander, M.W. (McDonnell Center for Space Sciences and Department of Physics, Washington University, St. Louis, Missouri 63130). Phys. Rev. Lett. 35: No. 17, 1167-1169 (27 Oct 1975).

It is shown that the cosmic-ray event recently interpreted as the track of a Dirac monopole can instead be plausibly described in terms of the interaction of an ultraheavy cosmic-ray nucleus, having $Z \sim 96$ and velocity $\sim 0.72c$. (auth)

Weak

Refer also to abstracts 14273–14275.

15721 ESTIMATION OF MISSING ENERGY IN ν INTERACTIONS IN HYDROGEN BUBBLE CHAMBERS. Grant, A. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Instrum. Methods; 127: No. 3, 355-359(15 Aug 1975).

A technique is suggested to estimate the incident neutrino energy in interactions in a hydrogen bubble chamber. The use of all kinematical constraints in multineutral events allows a good estimate of the missing energy and corresponding error. (NL)

15722 STRANGE PARTICLE PRODUCTION AND CHARMED PARTICLE SEARCH IN THE GARGAMELLE NEUTRINO EXPERIMENT. Deden, H.; Hasert, F. J.; Krenz, W.; von Krogh, J.; Lanske, D.; Morfin, J.; Pohl, M.; Schultze, K.; Weerts, H. (Technische Hochschule Aachen (F. R. Germany). 3. Physikalisches Inst.); Bertrand-Coremans, G. H. Phys. Lett., B; 58: No. 3, 361-366(15 Sep 1975).

Data is given for single and multiple strange particle production in neutrino reactions in both charged and neutral current channels. A total of 15000 neutrino and antineutrino events has been examined for possible evidence of semileptonic decay of a charmed particle. One candidate has been observed. Upper limits on charmed particle production cross sections are given as a func-

tion of the neutrino energy and the invariant mass of the final state hadrons. (NL)

15723 MEASUREMENT OF THE K⁰/sub s/ yields pi⁺pi⁻/ pi⁰pi⁰ BRANCHING RATIO. Everhart, G. C. Philadelphia; Univ. of Pennsylvania (1975). 102p. University Microfilms Order No. 75-24,062.

Thesis (Ph. D.).

A measurement of the branching ratio R equals GAMMA(K⁰/sub s/ yields pi⁺pi⁻)/GAMMA(K⁰/sub s/ yields pi⁰pi⁰) was carried out using an array of wire spark chambers interleaved with lead and copper radiators as a detector. The apparatus included a tungsten wall and anti-counter to define the upstream edge of the decay region and featured a segmented target approximately 3 K⁰/sub s/ mean free paths long so constructed that the K⁰ production point could be determined to within $\frac{1}{4}$ in. From the 1971 charged and 1315 neutral decays that were observed, a branching ratio R equals 2.11 +- 0.09 was found, in agreement with the world average of 2.21 +- 0.03. (Diss. Abstr. Int., B)

15724 SEARCH FOR WEAK NEUTRAL CURRENTS IN SEMI-LEPTONIC INTERACTIONS. Messing, F. Philadelphia; Univ. of Pennsylvania (1975). 152p. University Microfilm Order No. 75-24,103.

Thesis (Ph. D.).

A search is made for weak neutral currents in semileptonic interactions. An experiment was performed in the neutrino beam of the Fermi National Accelerator Laboratory. While the existence of events without muons is strongly supported by the data, it is not yet possible to pin down their source. Several possibilities are considered which are consistent with the data. These include heavy lepton production, violation of muon number conservation, and the existence of weak neutral currents. For the case of heavy leptons it is shown that a mass of 3.1 +- 0.5 GeV/c^2 and a small branching ratio into final states with muons would explain the observations. Under the assumption that weak neutral currents are the source, the space-time properties of the current are discussed in light of the variation of R with the energy transferred to the hadron system. (Diss. Abstr. Int., B)

15725 MEASUREMENT OF NEUTRINO AND ANTINEUTRINO TOTAL CROSS SECTIONS AT HIGH ENERGY. Barish, B.C.; Bartlett, J.F.; Buchholz, D.; Humphrey, T.; Merritt, F.S.; Sciulli, F.J.; Stutte, L.; Shields, D.; Suter, H. (California Institute of Technology, Pasadena, California 91125); Fisk, E.; Krafczyk, G. Phys. Rev. Lett. 35: No. 20, 1316-1320 (17 Nov 1975).

Charged-current ν and $\bar{\nu}$ data are reported from the first application at Fermilab of a narrow-band neutrino beam for the measurement of normalized cross sections. Cross sections of about 20% accuracy were measured with a 120-GeV secondary hadron beam for ν ($\bar{\nu}$) originating from π decay ($\langle E_\nu \rangle = 38$ GeV) and K decay ($\langle E_\nu \rangle = 105$ GeV). The ν and $\bar{\nu}$ fluxes were determined by directly measuring the hadron flux and the $\pi/K/p$ ratios for the hadron beam. (auth)

15726 LEPTONIC DECAYS OF THE Σ⁻ AND Ξ⁻ HYPERONS. Tanenbaum, W.; Hungerbühler, V.; Majka, R.; Marx, J.N.; Némethy, P.; Sandweiss, J.; Willis, W.J. (Yale University, New Haven, Connecticut 06520); Atac, M.; Ecklund, S.; Gollon, P.J.; Lach, J.; MacLachlan, J.; Roberts, A.; Stefanski, R.; Theriot, D.; Wang, C.L. Phys. Rev. D 12: No. 7, 1871-1883 (1 Oct 1975).

The decays $\Sigma^- \to n e^- \bar{\nu}$, $\Sigma^- \to \Lambda e^- \bar{\nu}$ ($\Lambda \to \pi^- p$), and $\Xi^- \to \Lambda e^- \bar{\nu}$ ($\Lambda \to \pi^- p$) were studied using unpolarized hyperons from the Yale-Fermilab-BNL hyperon beam at the Brookhaven National Laboratory Alternating Gradient Synchrotron. The Σ^-, Ξ^-, e^-, and Λ-decay-product momenta were measured by magnetic spectrometers with magnetostrictive wire spark chambers. A threshold Čerenkov counter and a total absorption calorimeter identified the electron and neutron, respectively. From a sample of 3507 reconstructed $\Sigma^- \to n e^- \bar{\nu}$ events we have found $|g_A/g_V| = 0.435 \pm 0.035$. From a sample of 55 reconstructed $\Sigma^- \to \Lambda e^- \bar{\nu}$ events we have found $g_V/g_A = 0.17 \pm 0.35$ assuming that the conserved vector current hypothesis correctly predicts the weak magnetic form factor. A new one-angle Cabibbo fit gives $f = 0.436 \pm 0.010$, $d = 0.812 \pm 0.011$, and $\theta = 0.232 \pm 0.003$ radian. (auth)

15727 FURTHER OBSERVATION OF DIMUON PRODUCTION BY NEUTRINOS. Benvenuti, A.; Cline, D.; Ford, W.T.; Imlay, R.; Ling, T.Y.; Mann, A.K.; Orr, R.; Reeder, D.D.; Rubbia, C.; Stefanski, R.; Sulak, L.; Wanderer, P. (Department of Physics, Harvard University, Cambridge, Massachusetts 02138). Phys. Rev. Lett. 35: No. 18, 1199-1202 (3 Nov 1975).

Using a quadrupole focused neutrino beam, 61 events with two muons in the final state have been observed at Fermilab. These include seven $\mu^-\mu^-$ events. A comparison of the event rate in two targets of different hadron absorption length indicates that attributing the events to π or K leptonic decay is ruled out by 4.0 standard deviations. No trimuon events were observed which, combined with lepton conservation, indicates an unobserved neutral lepton is present in most of the events. (auth)

15728 CHARACTERISTICS OF DIMUONS AS EVIDENCE FOR A NEW QUANTUM NUMBER. Benvenuti, A.; Cline, D.; Ford, W.T.; Imlay, R.; Ling, T.Y.; Mann, A.K.; Orr, R.; Reeder, D.D.; Rubbia, C.; Stefanski, R.; Sulak, L.; Wanderer, P. (Department of Physics, Harvard University, Cambridge, Massachusetts 02138). Phys. Rev. Lett. 35: No. 18, 1203-1206 (3 Nov 1975).

Neutrino-induced dimuon events probably involve the production and subsequent decay of one or more real, intermediate particles. The observed properties of dimuon events are shown not to agree with the hypotheses that the intermediate particles are heavy leptons or semiweak vector bosons. This strongly suggests production of new hadrons as the leading explanation of dimuon events. Such new hadrons, decaying weakly, would necessarily possess a new, as yet unidentified, quantum number. (auth)

Strong (Baryon-induced)

Refer also to abstract 15987.

15729 (EFI-82(74)) RATIO OF CHARGED HADRONS TO NEUTRONS AT MOUNTAIN ALTITUDES. Azaryan, M. O.; Kyurkchyan, G. A.; Mamidzhanyan, E. A.; Muradyan, M. M. (Erevanskij Fizicheskij Inst. (USSR)). 1974. 22p. (In Russian). INIS.

16 refs.; 6 figs.; 3 tables.

A determination was made of the hadron/neutron ratio on high mountains, the fraction of pions among the hadrons with $E_\pi > 10^3$ GeV, and the ratio of the number of leading (secondary) pions to the number of protons on interaction of nucleons with nuclei of the atmosphere. The purpose of this study was to determine the ratio of the number of leading pions to the number of protons with $E_{pr} > 10^3$ GeV by using an ionization calorimeter. At a nucleon energy of $E_N \sim 5 \times 10^4$ GeV the number of pions which are generated is approximately a factor of 10 greater ($\pi/p = \sim 9.5 \pm 3.1$) than the number of protons in interactions of the nucleons with nuclei of the atmosphere ($N \to A_{it}$). (tr-auth)

15730 MEASUREMENT OF PARTICLE AND ANTI PARTICLE ELASTIC SCATTERING ON PROTONS BETWEEN 6 AND 14 GeV. Brandenburg, G.; Carnegie, R. K.; Cashmore, R. J.; Davier, M.; Leith, D. W. G. S.; Matthews, J.; Walden, P.; Williams, S. H.; Winkelmann, F. (Stanford Linear Accelerator Center, Calif. (USA)). Phys. Lett., B; 58: No. 3, 367-370(15 Sep 1975).

Differential cross sections in the t-range between 0.02 and 1.5 GeV² have been measured for the elastic scattering of particles and antiparticles on protons at 6.4, 10.4 and 14 GeV for $K^\pm p$ and 10.4 GeV for $\pi^\pm p$ and $p^\pm p$. Large statistics have been achieved and systematic uncertainties have been minimized. The relative systematic uncertainty between particle and antiparticle data is less than 0.5%. Accurate measurements of the position of the first crossover between particle and antiparticle differential cross sections have been performed. As the energy increases from 6.4 to 14 GeV the $K^\pm p$ crossover moves to smaller values by 0.010 GeV² with a statistical error of 0.006 GeV² and a systematic uncertainty of 0.005 GeV². The crossover positions at 10.4 GeV for $\pi^\pm$, $K^\pm$ and $p^\pm$ scale approximately with the interaction radii. (NL)

15731 MEASUREMENT OF ELASTIC SCATTERING OF HADRONS ON PROTONS FROM 50 TO 175 GeV/*c*. Phys. Rev. Lett. 35: No. 18, 1195-1199 (3 Nov 1975).

Differential cross sections have been measured at Fermilab with a focusing spectrometer for $\pi^+ p$, $K^+ p$, and $p^+ p$ elastic scattering at 50-, 70-, 100-, 140-, and 175-GeV/*c* incident momentum over the $|t|$ range 0.03 to 0.8 GeV². The results are smooth in t and are parametrized by quadratic exponential fits. (auth)

Strong (Meson-induced)

15732 (CEA-N-1791, pp 104) EXPERIMENTAL SEARCH FOR ΔΔ COMPONENT IN THE DEUTERON. Beurtey, R.; Cvijanovich, G.; Dubal, L.; Duchazeaubeneix, J. C.; Duhm, H.; Faivre, J. C.; Goldzahl, L.; Lugol, J. C.; Perdrisat, C. F.; Saudinos, J. [nd]. (In French)

In Department of Nuclear Physics. Progress report 1 October 1973–30 September 1974. (CEA Centre d'Etudes Nucleaires de Saclay, 91–Gif-sur-Yvette (France). Dept. de Physique Nucleaire).

The backward protons produced by incident π^- beam of 0.98 GeV energy on deuterons were measured, searching for a ΔΔ component in the ground state deuteron wave function. (FR)

15733 (CEA-N-1791, pp 154-156) NEGATIVE PION CAPTURE WITH EMISSION OF A SINGLE PROTON. Bertin, P.; Bihoreau, B.; Coupat, B.; Gerard, A.; Isabelle, D.; Kawadry, G.; Miller, J.; Morgenstern, J.; Mouhot, R.; Picard, J. [nd]. (In French)

In Department of Nuclear Physics. Progress report 1 October 1973–30 September 1974. (CEA Centre d'Etudes Nucleaires de Saclay, 91–Gif-sur-Yvette (France). Dept. de Physique Nucleaire).

The absorption of π^- with single proton emission is sensitive to short-range correlations. A branching ratio of a few 10^{-6} was found for ^{14}N target and the residual nucleus in ground state. This branching ratio is 4.5×10^{-4} for ^{12}C, ^{13}B target summed up on all the states of the residual nucleus. (FR)

15734 (CRN/HE-74-11) MULTIPION SYSTEMS PRODUCED IN THE REACTION $\pi^+N \rightarrow N\pi^+\pi^+\pi^-\pi^0\pi^0$ AT 3.5GeV/c. Riester, J.-L. (Centre National de la Recherche Scientifique, 67 – Strasbourg (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France)). 1974. 154p. (In French). INIS.

A detailed analysis is presented of events belonging to the final state $N2\pi^+\pi^-2\pi^0$ produced in π^+ nuclei interactions at 3.5 GeV/c in a heavy liquid bubble chamber. Individual particle momentum distributions as well as center of mass angular emission distributions display deviations from the statistical phase space. A strong angular correlation is found in particular between the two π^0 which cannot be explained by the symmetrization of the wave functions and which produces an enhancement at low $\pi^0\pi^0$ masses. The ω^0 production is found in 39 ± 7% of the events and the cross section on hydrogen is estimated at 1.1 ± 0.3 mb. (FR)

15735 (CRN/HE-75-1) FEATURES OF THE $\pi^0\pi^0$ SYSTEM PRODUCED IN 5π FINAL STATES BY 3.5 GeV/c π^+. Riester, J. L.; Arnold, R.; Engel, J. P.; Paty, M. (Centre National de la Recherche Scientifique, 67 – Strasbourg (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France)). 1975. 12p. INIS.

Angular correlations between two pions in the 5-pions final states are studied. A comparison between neutral, like-charged and unlike charged pion–pion systems is done. Evidence is shown for a strong $\pi^0\pi^0$ correlation in the asymmetry parameters as well as in the mass distribution. This effect is interpreted in terms of the scattering length approximation. (FR)

15736 (DESY-75/37) RECENT RESULTS FROM DORIS. Wiik, B. H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Oct 1975. 39p. Dep. NTIS (US Sales Only) $4.00.

The present status of the accelerator is described, and the data obtained with the double-arm spectrometer DASP and the superconducting solenoid PLUTO are discussed. The experiments are inclusive distributions, particle ratios, and limits on heavy charged mesons from the decays of the J/ψ and ψ' resonances, hadronic two-body decays of J/ψ and ψ', the cascade decay: $\psi' \rightarrow (J/\psi) + X$, evidence for narrow states P_c with even charge conjugation and masses between 3.7 and 3.1 GeV, two-photon final states, and three-photon final states and evidence for a new resonance. (JFP)

15737 (JINR-1-8064) MOMENTUM AND ANGULAR CHARACTERISTICS OF π-p INTERACTIONS AT 40 GeV/c. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1974. 27p. (In Russian). INIS.

5 refs.; 11 figs.; 10 tables; submitted to Soviet Journal of Nuclear Physics.

This study presents momentum and angular distributions of π^+, π^- mesons and γ quanta obtained from an investigation of ~2000 π^-p interactions at a momentum of 40 GeV/c. The momentum spectra of π^+ and π^- mesons in the laboratory system of coordinates is approximated by a sum of two and three exponents. The momentum spectra in the C-system are approximated by Planck's function. It was found that the Planck function does not describe the distribution of π^+ and π^- mesons in the C-system and in the natural (S)-system. The spectrum of the leading mesons is obtained. The average number of leading pions is equal to $n_L = 0.25 \pm 0.05$. (tr-auth)

15738 (LUIP-CR-75-02) TRANSVERSE MOMENTUM DISTRIBUTIONS OF MULTIPLY CHARGED FRAGMENTS IN ^{16}O-EMULSION NUCLEUS INTERACTIONS AT 2.0 GeV/NUCLEON. Jakobsson, B.; Kullberg, R.; Otterland, I. (Lund Univ. (Sweden). Fysiska Institutionen). Apr 1975. 12p. Dep. NTIS (US Sales Only) $3.50.

Transverse momentum distributions of relativistic multiply charged fragments in ^{16}O-emulsion nucleus interactions are discussed. C-, N-, and O-isotopes as well as He-isotopes in events with three He-particles show Gaussian transverse momentum distributions. Momentum distributions of He-isotopes in reactions with one or two He-particles deviate considerably from this picture. (auth)

15739 INVESTIGATION OF THE LOW-MASS $\pi K\bar{K}$ SYSTEM IN THE REACTIONS $\pi^+p \rightarrow (\pi^+K^+K^-)p$ AT 16 GeV/c. Otter, G.; Rudolph, G.; Seyfert, H. H.; Wieczorek, H. (Technische Hochschule Aachen (F. R. Germany). 3. Physikalisches Inst.); Becker, L.; Lohmann, W. (Akademie der Wissenschaften der DDR, Berlin-Zeuthen. Inst. fuer Hochenergiephysik); Boeckmann, K.; Hartmann, R.; Lowsky, J. (Bonn Univ. (F. R. Germany). Physikalisches Inst.); Cocconi, V. T. Nucl. Phys., B; 96: No. 3, 365-378(29 Sep 1975).

The reactions $\pi^+p \rightarrow (\pi^+K^+K^-)p$ are studied, at 16 GeV/c, and in particular the low-mass $\pi^+K^+K^-$ system is compared with the diffractively produced 3π system in the reactions $\pi^+p \rightarrow (\pi^+\pi^+\pi^-)p$ at the same energy. Similarities are found in (a) the weak energy dependence of their cross sections, (b) the shape of the three-meson mass spectra, (c) the differential cross sections which have the same slope for the same value of the three-meson invariant mass, (d) the general characteristics of the partial-wave composition of the low-mass three-meson system (as for the 3π case, the πKK system is produced in unnatural spin-parity states with $J^P = 1^+$ dominant at low πKK mass, the state $J^P = 0^-$, however, may be relatively more abundant in the $\pi K\bar{K}$ than in the 3π case) and (e) the exchange which is almost entirely of natural parity. It is concluded that the reaction $\pi^+p \rightarrow (\pi^+K^+K^-)p$, for low values of the πKK mass, represents the diffractive dissociation process $\pi \rightarrow \pi K\bar{K}$, which is less probable than $\pi \rightarrow \pi\pi\pi$ by one order of magnitude. (NL)

15740 K^0 PRODUCTION BY K^+ ON PLATINUM AT 3 GeV/c. Smoot, G. F.; Fackler, O. D.; Frisch, D. H.; Martin, J. F.; Sompayrac, L. M. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Physics). Nucl. Phys., B; 96: No. 3, 379-400(29 Sep 1975).

The momenta of about 2600 K^0's produced by 2.93 GeV/c K^+'s in the reaction K^+ + Pt (or scintillator) $\rightarrow K^0$ + anything have been measured. The yields are presented in a form available for designing high-energy K^0 sources. A simple model treats the kaon-nucleon interactions in the nucleus as though the nucleons were free except for the effects of the Fermi distribution and exclusion of final momenta. Single inelastic and double elastic-inelastic elementary particle interactions are all that need to be considered to give a good fit to the data over the limited (0° to about 30°) range of production angles observed. This requires an extensive calculation of the probabilities for forming the various final states, and for observing the K^0's with the target and veto used. (NL)

15741 FEATURES OF THE $\pi^0\pi^0$ SYSTEM PRODUCED IN 5π FINAL STATES BY 3.5 GeV/c π^+. Riester, J. L.; Arnold, R.; Engel, J. P.; Paty, M. (Centre National de la Recherches Nucleaires). Nucl. Phys., B; 96: No. 3, 407-412(29 Sep 1975).

Angular correlations between two pions in the 5-pion final states are studied. A comparison between neutral, like-charged and unlike-charged pion-pion systems is done. Evidence is shown for a strong $\pi^0\pi^0$ correlation in the asymmetry parameters as well as in the mass distribution. This effect is interpreted in terms of the scattering length approximation. (NL)

15742 SHAPE OF THE INVARIANT DIFFERENTIAL CROSS SECTION IN THE REACTIONS $K^-p \rightarrow \bar{K}^0$ + ANYTHING AND $K^-p \rightarrow \Lambda$ + ANYTHING AT 8.2 GeV/c. Simopoulou, E.; Fry, J. R.; Muirhead, H.; Rohringer, H. (Liverpool Univ. (UK)); Filippas, T. A.; Grammatikakis, G.; Vayaki, A. (Democritus Nuclear Research Center, Athens (Greece)); Apostolakis, A.; Michaelidis, P.; Spiropoulou, M. Nucl. Phys.; B; 96: No. 3, 413-425(29 Sep 1975).

The energy dependence and shape of the differential cross sections for the reactions $K^-p \rightarrow \bar{K}^0$ + anything and $K^-p \rightarrow \Lambda$ + anything have been studied in the kaon and proton fragmentation regions. It has been shown that their behavior may be understood within the framework of the triple-Regge model, and that the dominant contribution to the shape of the differential cross section comes from the intercepts of the appropriate trajectories. (NL)

15743 SEARCH FOR EXOTIC MESON AND HYPERON FINAL STATES IN K^-d INTERACTIONS AT 5.5 GeV/c. Davis, R.; Ammar, R.; Kropac, W.; Yarger, H. (Kansas Univ., Lawrence (USA)); Werner, B. (Community College of Allegheny County, Pittsburgh, Pennsylvania 15212, USA); Cho, Y.; Johnson, D.; Musgrave, B.; Wangler, T. (Argonne National Lab., Ill. (USA)). Nucl. Phys., B; 96: No. 3, 426-434(29 Sep 1975).

A search has been made for exotic states produced in K^-d interactions at 5.5 GeV/c. The reactions investigated were: $K^-d \rightarrow X^{2-}pp$, $K^-d \rightarrow Y^{*2-}\pi^+p$ and $K^-d \rightarrow M^{2-}\Sigma^+p$. Upper limits are set for the production cross sections. (NL)

15744 PRODUCTION OF ELECTRON-POSITRON PAIRS, MUON PAIRS, AND GAMMA RAY PAIRS FROM ELECTRON-POSITRON ANNIHILATION AT CENTER OF MASS ENERGIES NEAR THE psi(3095) REST ENERGY. Ford, R. L. Stanford,

CA; Stanford Univ. (1975). 162p. University Microfilms Order No. 75-25,525.

Thesis (Ph. D.).

The cross sections for the production of electron-positron pairs, muon pairs and gamma ray pairs from electron-positron annihilation were measured at center of mass energies near the PSI(3095) rest energy. The electron-positron storage ring SPEAR was used to provide the colliding beams. The experimental apparatus consisted of two identical spectrometers oriented in a collinear configuration at right angles with the beam. Each spectrometer consisted of five multiwire proportional chambers, an optional gamma ray converter, two plastic scintillation counters, a large sodium iodide total absorption shower counter and a thick steel absorber. Enhancements in the cross sections for electron-positron and muon pair production were observed, but not in the cross section for pairs of gamma rays. It is concluded that the PSI(3095) decays with approximately equal probability into electron-positron pairs and muon pairs, but not into gamma ray pairs. (Diss. Abstr. Int., B)

15745 CORRELATION EFFECTS IN HIGH ENERGY HADRON PHYSICS. Del Prete, T. (Istituto Nazionale di Fisica Nucleare, Pisa, Italy). Riv. Nuovo Cim.; 5: No. 4, 532-560(1975).

The review of correlation effects in high energy hadron physics includes the most recent experimental data at the highest energies and semi-inclusive data. The correlations considered are rapidity, transverse-momentum, integrated, long and short-range, and high momentum-transfer. (JFP)

15746 SEARCH FOR Ξ^* RESONANCES IN 2.87-GeV/c K^-n INTERACTIONS. Briefel, E.; Gourevitch, S.A.; Kirsch, L.; Schmidt, P. (Brandeis University, Waltham, Massachusetts 02154); Chang, C.Y.; Staab, R.; Yodh, G.B.; Fernow, R.; Gauthier, P.; Moneti, G.; Goldberg, M.; Canter, J.; Mann, W.A.; Schneps, J.; Tompkins, J.; Wolsky, G. Phys. Rev. D 12: No. 7, 1859-1870 (1 Oct 1975).

We report on a search for Ξ^* production in the mass range 1.5–2.0 GeV/c^2 in K^-n interactions at 2.87 GeV/c. Upper limits on Ξ^* production cross sections, as well as reaction cross sections for those final states in which Ξ^*'s may be observed, are presented. In particular, an upper limit of 5.4 μb is placed on production of an isospin-3/2 Ξ^{*--}. (auth)

Particle Interactions and Properties (Theoretical)

General

Refer also to abstracts 15740, 16098, 16152, 16193, 16200, and 16205.

15747 (DAMTP-75/6) CONFINED QUARKS, BJORKEN SCALING AND CURRENT ALGEBRA. Polkinghorne, J. C. (Cambridge Univ. (UK). Dept. of Applied Mathematics and Theoretical Physics). Mar 1975. 16p. Dep. NTIS (US Sales Only) $3.50.

A simple model of confined quarks is presented which resembles the massive quark model in the calculation of structure functions and which has the property that is manifestly consistent with current algebra. (auth)

15748 (IN-2P3-EC-74(Vol.2), pp 161-193) DEEP INELASTIC PROCESSES AND THE PARTON MODEL. Altarelli, G. [nd].

From summer school on particle physics; Gif-sur-Yvette, France (9 Sep 1974).

Distributed by M.S. Detoeuf, IN2P3, 11 rue Pierre et Marie Curie, 75231 Paris Cedex 05.

In summer school on particle physics. Gif-sur-Yvette, 9-21 September 1974. (Institut National de Physique Nucleaire et de Physique des Particules, 75 – Paris (France)).

The lecture was intended as an elementary introduction to the physics of deep inelastic phenomena from the point of view of theory. General formulae and facts concerning inclusive deep inelastic processes in the form: $l + N \rightarrow l' +$ hadrons (electroproduction, neutrino scattering) are first recalled. The deep inelastic annihilation $e^+e^- \rightarrow$ hadrons is then envisaged. The light cone approach, the parton model and their relation are mainly emphasized. (FR)

15749 (IPNO-CF-75-1, pp 232-269) INTRODUCTION TO THE GAUGE THEORIES UNIFYING THE ELECTROMAGNETIC AND WEAK INTERACTIONS. Pham Xuan-Yem. [nd]. (In French)

From 6th meeting of the Theoretical Physics Division; Aussois France (5 Apr 1974).

In proceedings of the sixth meeting of the Theoretical Physics Division. Aussois, 5-10 April 1974. (Paris-11 Univ., 91 – Orsay (France). Inst. de Physique Nucleaire).

An elementary introduction to unified gauge theories of electromagnetic and weak interactions is presented. The Goldstone theorem and the Higgs mechanism are discussed. The Weinberg-Salam model as well as the Georgi-Glashow ones are explained in detail. Emphasis is on the experimental consequences of the Weinberg-Salam model (neutral current). (FR)

15750 (IPNO-CF-75-1, pp 270-355) HIGH ENERGY HADRON INTERACTION. Nicolesco, B. [nd]. (In French)

From 6th meeting of the Theoretical Physics Division; Aussois, France (5 Apr 1974).

In proceedings of the sixth meeting of the Theoretical Physics Division. Aussois, 5-10 April 1974. (Paris-11 Univ., 91 – Orsay (France). Inst. de Physique Nucleaire).

The experimental data at medium energies (10 approximately $<P_L$ approximately <50GeV/c) and high energies (50 approximately $<P_L$ approximately <1500GeV/c) are reviewed. The new high energy effects connected with the behavior of the total cross sections, the phase of the forward amplitude, the diffraction slope and also with the structure of the differential cross sections are underlined. Some theoretical models which can explain some of these new effects are next studied: (1) optical model; (2) reggeonic calculus based on critical phenomena; (3) asymptotic oscillations. A reformulation of the principle of the maximal strength of strong interactions, which leads to a global and unconventional description of hadron-hadron scattering at high energy is also studied. (FR)

15751 (IPNO-CF-75-1, pp 353-376) GLAUBER MODEL AND ITS GENERALIZATIONS. Bialkowski, G. [nd].

From 6th meeting of the Theoretical Physics Division; Aussois, France (5 Apr 1974).

In proceedings of the sixth meeting of the Theoretical Physics Division. Aussois, 5–10 April 1974. (Paris-11 Univ., 91–Orsay (France). Inst. de Physique Nucleaire).

The physical aspects of the Glauber model problems are studied: potential model, profile function and Feynman diagrams approaches. Different generalizations of the Glauber model are discussed: particularly higher and lower energy processes and large angles. (FR)

15752 (ITP-75-77R) AUTOMODALITY IN THE PHYSICAL REGION AND THE JOST–LEHMANN–DYSON REPRESENTATION. Zavyalov, B. I.; Maksimov, S. I. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1975. 19p. (In Russian). Dep. NTIS (US Sales Only) $3.50.

A sufficient condition for automodality of the form for spacelike ρ is given in terms of the quasi-asymptotic properties of the spectral function of the Jost-Lehmann representation. The correspondence between these properties and the behavior of the Fourier-transforms of the form factors in the light-cone vicinity is stated. (auth)

15753 MIRROR FERMIONS, J/ψ PARTICLES, KOLAR-MINE EVENTS AND NEUTRINO ANOMALY. Pati, J. C.; Salam, A. (International Centre for Theoretical Physics, Trieste (Italy)). Phys. Lett., B; 58: No. 3, 333-337(15 Sep 1975).

The role of color and charm and heavy mirror fermions (suggested earlier in the context of a unification scheme) is explored in interpreting the J/ψ particles, the Kolar-mine events and the neutrino-antineutrino anomaly. (NL)

15754 THE MESON AND THE BARYON IN THE ONE-LOOP DUAL MODEL OF THE POMERON. Pennington, M. R.; Gula, A. (Science Research Council, Chilton (UK). Rutherford Lab.). Nucl. Phys., B; 96: No. 3, 535-545(29 Sep 1975).

In the lowest order dual loop perturbation theory the crossing and factorization properties of the pomeron are considered. It is shown that the baryon loop is the necessary complement of the single crossed meson loop in building the low-energy pomeron. Recent experimental indications that in this energy region the pomeron is different in MM, MB and BB processes are naturally explained. (NL)

15755 THE DISCRET CHARM OF PARTICLES. de Closets, F. Sci. Avenir; No. 340, 524-529(Jun 1975). (In French)

It is shown that the proceeding which caused physicists to introduce a new quantum number, charm, into the theory of elementary particles are the same as those which led to the introduction of isotropic spin, hypercharge, strangeness or color. Postulated as early as 1964 in the quark model by Glashow and Bjorken, with the charmed quark, it resurfaced in a roundabout way with neutral currents confirmed by neutrino experiments. The stability of the ψ mesons discovered at 3.1 GeV and 3.7 GeV in 1975 would be due to a disintegration into D mesons (charmed mesons) of mass between 1850 and 2050 GeV. Meanwhile Brookhaven seems to have discovered a 2426 GeV charmed baryon. (FR)

15756 BRIEF ACCOUNT OF THE PROGRESS OF HIGH-ENERGY PHYSICS. Hung-yuan, C. Kexue Tongbao (Scientia) (Engl. Transl.); 18: No. 1, 5-12(Jul 1973).

Translated from Kexue Tongbao; 18: No. 1, 4-10(Jul 1973).

The review of high energy physics covers the kinds of particle interactions, cosmic-ray and accelerator research, the use of nuclear theory, hadron structure, the search for quarks, and CP violation, resonances. (JFP)

15757 VECTOR FIELD, GAUGE CONDITION AND STRING MODEL. Takahashi, K. (Tohoku Univ., Sendai). Lett. Nuovo Cim.; 14: No. 9, 341-343(1 Nov 1975).

It is seen that there exist certain correspondences between subsidiary conditions of local fields and gauge conditions in dual models. These correspondences may be an indication of the bag nature of hadrons, in which local fields are obtained. (SDF)

15758 AMBIGUITY IN PADE-APPROXIMANT CALCULATIONS. Betlach, T. L. (Univ., of California, San Diego, La Jolla). Lett. Nuovo Cim.; 13: No. 18, (23 Aug 1975).

Attention is called to the fact that owing to poor convergence properties, the numerical results of Pade calculations can and do depend sensitively on the way in which one does the renormalization. There is consequently, an element of ambiguity in such calculations. Furthermore, the resulting numerical effects can be quite large. The linear sigma model is used as an illustration. One can calculate the rho width, which characterized the behavior of the amplitude, for which two alternative predictions are made, in the vicinity of the rho mass. The result is GAMMA/sub rho/ approximately equal to 35 MeV. The calculation of this quantity is clearly very sensitive to a change in the renormalization procedure, the reason being the poor convergence properties of the perturbation series. A change in the renormalization procedure is equivalent to a rearrangement of the perturbation series. Finally if the Pade formula is to be used as a basis for phenomenology, these considerations show that one renormalization may yield better fits than another one. (JFP)

15759 DUAL STRING MODELS AND QUANTUM GRAVITY. Yoneya, T. (Hokkaido Univ., Sapporo (Japan). Dept. of Physics). pp 180-183 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 9 figs.

The fermionic string of Ramond is considered. The problem is to construct the dual model counter-part of the theory of interacting gravitational and spinor fields in usual local field theory. (DE)

15760 THE CANONICAL QUANTIZATION OF A RELATIVISTIC STRING. Chikashige, Y. (Tokyo Univ. (Japan). Dept. of Physics); Kamimura, Kiyoshi (Tokyo Metropolitan Univ. (Japan). Dept. of Physics). pp 187-188 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 4 refs.

A free motion of a relativistic string is described within the framework of the canonical formalism. This problem is considered from a more general point of view by quantizing a system with some constraints and clarification of the meaning of Goddard's, Goldstone's, Rebbi's and Thorn's treatment. (DE)

15761 ALGEBRAIC METHODS AND QUARK STRUCTURE. Guersey, F. (Yale Univ., New Haven, Conn. (USA). Dept. of Physics). pp 189-195 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 19 refs.

The incorporation of charges in field theory has brought new features such as gauge invariance for the electric charge, spontaneous breakdown of symmetry for chiral charge and asymptotic freedom for Yang-Mills type gauge theory of non abelian charges. The main topics are: the role of $SU^c(3)$, the Hurwitz and Rozenfeld algebras, the algebras J(d,d') of generalized observables, the quark structure of the exceptional groups, the lepton-quark symmetry and symmetry breaking chains. (DE)

15762 FIELD THEORETICAL APPROACH TO COMPOSITE PARTICLE REACTIONS. Kinoshita, K. (Kyushu Univ., Fukuoka (Japan). Dept. of Physics). pp 116-117 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 3 refs.

The purpose of the study is to obtain unified understanding of high energy hadron phenomena from the composite model of hadrons, on the basis of urbaryon field theory. A brief report of recent progress and conjectures are given. (DE)

15763 AUTOMORPHISMS AND QUASI-FREE STATES OF THE CAR ALGEBRA. Hugenholtz, N. M. (Rijksuniversteit Groningen (Netherlands). Instituut voor Theoretische Natuurkunde); Kadison, R. V. (Pennsylvania Univ., Philadelphia (USA). Dept. of Mathematics). Commun. Math. Phys.; 43: No. 2, 181-197 (Jul 1975).

17 refs.

A study is made of automorphisms of the CAR algebra which map the family of gauge-invariant, quasi-free states of the CAR algebra onto itself and it is shown that they are one-particle automorphisms. (DE)

15764 SPONTANEOUS BREAKING OF CHIRAL SYMMETRY IN A VECTOR-GLUON MODEL. Maskawa, T.; Nakajima, H. (Kyoto Univ. (Japan). Dept. of Physics). pp 242-244 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 6 refs.

A suitable gauge for the vector-gluon is chosen and, for simplicity, a pole-approximation to the massive vector-gluon propagator is made but no radiative correction to the vertex function in the Schwinger-Dyson equation for the fermion self-energy part. The results of the analysis are presented. Finally a comment is given on some aspects of the dynamical Higgs mechanism. (DE)

15765 THE PHYSICS OF MAGNETIC MONOPOLES. A Contribution to the Magnetic Model of Matter. Barut, A. O. (Colorado Univ., Boulder (USA). Dept. of Physics and Astrophysics). Phys. Bl.; 31: No. 8, 352-361(Aug 1975). (In German).

4 figs.; 10 refs.

The conclusions of the existence of magnetic monopoles and dyons for the Maxwell equations are discussed. The modified Maxwell equations offer the possibility of describing the strong and electromagnetic interaction by a single coupling constant. (DE)

15766 CLASSICAL PARTICLE MODEL IN FIVE DIMENSIONAL RELATIVITY. Moose, A. E. Garden City, NY; Adelphi Univ. (1975). 111p. University Microfilms Order No. 75-25,482.

Thesis (Ph. D.).

A classical field theory model of an uncharged particle using five dimensional relativity is discussed. The model makes use of the Einstein-Rosen concept of associating a topological hole in space-time with an elementary particle. Unlike other treatments of five dimensional relativity, the g_{55} component of the metric is allowed to be a dynamical object with the field equations determining its functional dependence on the coordinates. It is found that g_{55} differs significantly from its value at infinity for only a limited region in the neighborhood of the particle, rho less than 10^{-13} cm. The five dimensional components of the metric may be grouped into a stress-energy source for the four dimensional Einstein equations. This enables one to model short range interactions with geometry. A singularity in the five dimensional metric, whose presence is indicated by the Hawking-Penrose theorem, was relegated to an unobservable region of space-time. The solution manifold thus obtained is found to have a throat suitable for the representation of an elementary particle. The spin of the particle is zero. Infinitely far from the particle, the metric reduces to the Minkowski metric. Closer in, but still in the asymptotic region, the Schwarzschild solution applies. However, within rho less than 10^{-13} cm, a throat exists and the metric functions are violently different from the Schwarzschild values. The geodesics for the solution are investigated and promising areas of further research listed. (Diss. Abstr. Int., B)

15767 THEORY OF REST-MASS QUANTIZATION. Chacko, T. (Mar Athanasium Coll. of Engineering, Kothamangalam, India). Int. J. Theor. Phys.; 12: No. 2, 95-102(Feb 1975).

The general relativity concept of density-dependent space-curvature and the mass-energy relation of special relativity indicate a rest-mass quantization rule which makes it possible to account for the interconversion of mass and energy in a simple manner and from which the known quantum postulates are obtained as corollaries, thereby throwing new light on the nature of matter and radiation, the uncertainty principle, and the structure of elementary particles. (auth)

15768 STATISTICS CONSISTENT WITH NAMBU'S NEW QUANTUM RULES: QUARKS. Sucre, M. G.; Kalnay, A. J. (Instituto Venezolano de Investigaciones Cientificas, Caracas). Int. J. Theor. Phys.; 12: No. 2, 149-151(Feb 1975).

The aim is to show that in a quantized theory outlined the main statistics used in quantum physics are consistent with Nambu's new quantum rules (Nambu. Phys. Rev. D; 7: 2405 (1973)). A quantum Nambu system of coordinates is compared with this quantized system with only one annihilation operator (the Bose of para-Bose case, the Fermi or para-Fermi case and the modified para-Fermi case). Single vacuum irreducible representations of parastatistics are used. It is shown that the quantized version of Nambu's new hamiltonian mechanics may be suitable for the quark model. (UK)

15769 MACROSCOPIC APPROACH TO STEADY-STATE BOOTSTRAP CURRENT AND PARTICLE TRANSPORT IN TOROIDAL GEOMETRY. Bornatici, M.; Engelmann, F.; Nocentini, A. (CNEN/EURATOM, Frascati, Italy). Riv. Nuovo Cim.; 5: No. 4, 617-647(1975).

Transport processes in toroidal geometry are studied from a macroscopic point of view. In particular, the macroscopic causes of radial particle transport and of bootstrap current as well as their interrelation are investigated. Somewhat greater detail is given than previous work, in particular the role played by special symmetry requirements in establishing a relation between bootstrap current and radial particle transport is considered. (JFP)

15770 SEPARABLE SOLUTIONS FOR DIRECTLY INTERACTING PARTICLE SYSTEMS. Foldy, L.L. (Physics Department, Case Western Reserve University, Cleveland, Ohio 44106); Krajcik, R.A. Phys. Rev. D 12: No. 6, 1700-1710 (15 Sept 1975).

The problem of constructing a representation of the Poincaré group corresponding to a directly interacting system of a finite number of particles and satisfying the condition that the interaction be separable is considered by expansion of the group generators in powers of $1/c^2$. It is established that the problem has a solution to order $1/c^2$, but, except in special cases, the solution requires that the interaction contain three-body terms to order $1/c^2$ if it is the sum of two-body terms only to nonrelativistic order. Furthermore, there is considerable arbitrariness in the $1/c^2$-order interaction term, and we discuss the possibility and significance of removing this arbitrariness by a unitary transformation. Finally, we discuss higher-order terms in $1/c^2$, where we present arguments to show that an N-particle system will eventually have some N-body interaction terms at some order in $1/c^2$ even though it contains only two-body terms nonrelativistically, and we then present some applications. (auth)

Electromagnetic

Refer also to abstract 16230.

15771 (DAMTP-75/7) POLARIZED COINCIDENCE ELECTROPRODUCTION: SCALING LAWS FOR THE FINAL STATE. Heimann, R. L. (Cambridge Univ. (UK). Dept. of Applied Mathematics and Theoretical Physics). Mar 1975. 46p. Dep. NTIS (US Sales Only) $4.00.

A study is made of the inclusive electroproduction of single hadrons off a polarized target. Bjorken scaling laws and the hadron azimuthal distribution are derived from the quark parton model. The polarization asymmetries scale when the target spin is along the direction of the virtual photon, and (apart from significant exception) vanish for transverse spin. These results have a simple explanation; emphasis is given both to the general mathematical formalism and to intuitive physical reasoning. Through this framework other cases are considered: quarks with anomalous magnetic moment; renormalization group effects and asymptotic freedom; production of vector mesons (whose spin state is analyzed by their decay); relation to large transverse momentum hadron production; and a covariant parton model calculation. Spin O partons and Regge singularities are also considered. All of these cases (apart from the last two) modify the pattern of conclusions. Vector meson production shows polarization enhancements in the density matrix element ρ_{0+}; the renormalization group approach does not lead to any significant suppressions. They are also less severe in parton models for large P_T hadrons, and are not supported by the covariantly formulated calculation. The origins of these differences are isolated and used to exemplify the sensitivity polarized hadron electroproduction has to delicate detail that is otherwise concealed. (auth)

15772 (DAMTP-75/8) CURRENT FRAGMENTATION IN DEEP INELASTIC SCATTERING. Hamer, C. J. (Cambridge Univ. (UK). Dept. of Applied Mathematics and Theoretical Physics). Apr 1975. 25p. Dep. NTIS (US Sales Only) $3.50.

It is argued that the current fragmentation products in deep inelastic electron scattering will not be distributed in a "one-dimensional" rapidity plateau as in the parton model picture of Feynman and Bjorken. A reaction mechanism with a multiperipheral topology, by which the above configuration might have been achieved, does not in fact populate the current fragmentation plateau; and unless partons are actually observed in the final state, it cannot lead to Bjorken scaling. The basic reason for this failure is shown to be the fact that when a particle is produced in the current fragmentation plateau, the adjacent momentum transfer in the multiperipheral chain becomes large and negative: such processes are inevitably suppressed. Instead, the current fragmentation products are likely to be generated by a fragmentation, or sequential decay process. (auth)

15773 (EFI-75(74)) TRANSITION RADIATION IN A SEMI-INFINITE WAVEGUIDE WITH A DIELECTRIC PLATE. Begloyan, E. A.; Gazazyan, E. D.; Laziev, E. M. (Erevanskij Fizicheskij Inst. (USSR)). 1974. 10p. (In Russian). INIS.

2 refs.; 1 fig.

A study was made of the transition radiation from a charged particle moving along the axis of a shorted, regular waveguide with a solid, uniform dielectric material as filler. The field and energy flux of the transition radiation were determined by decomposing the radial cross section of the waveguide according to eigenfunctions. At $E_1 > E_2$ in the region of frequencies $c\lambda_n/\sqrt{E_1} < \omega < c\lambda_n/\sqrt{E_2}$ (λ_n are the radial wave numbers), the plate is equivalent to a resonator, whose eigenfrequencies satisfy the equation $\mathrm{tg}\,\gamma_n d = -(E_1 G_n)/(E_2 \gamma_n)$. The energy of the radiation "locked" in the plate is determined. It is shown that in the case of a thin plate $\gamma_n d \ll 1$, $G_n D \ll 1$, the radiation has a dipole character. (tr-auth)

15774 (EFI-76(74)) PHOTON FRAGMENTATION INTO THE NEUTRAL VECTOR MESONS. Pirogov, Yu. F.; Ter-Isaakyan, N. L. (Erevanskij Fizicheskij Inst. (USSR)). 1974. 11p. INIS.

14 refs.; 3 figs.

A look is taken at the process of the inclusive photo- and electro-generation of neutral vector mesons $v^0 = \rho^0, \omega, \psi\gamma p \to v^0 X$, $ep \to ev^0 X$ in the three-Regge region. On the basis of present data on the elastic photo- and electrogeneration $\gamma p \to v^0 p$, $ep \to ev^0 p$ and on the inclusive generation $pp \to pX$ an estimate is made of the fragmentation $\gamma \to v^0$ at high energies. It is noted that it is possible to use the inclusive electro- and photo-generation of v^0 in order to investigate the three-pomeron peak. (tr-auth)

15775 (EFI-83(74)) STUDY ON CASCADE SHOWERS IN IRON. Azaryan, M. O.; Mamidzhanyan, E. A. (Erevanskij Fizicheskij Inst. (USSR)). 1974. 10p. (In Russian). INIS.

6 refs.; 3 figs.; 1 table.

The object of the study is the coefficient α establishing the relation between the measured ionization I and the energy E_0 of the primary particle causing the ionization I. The purpose of the study is to determine the energy E_0 calorimetrically. From the results of the measurement it is possible to calculate $\alpha = (1.54 \pm 0.03) \cdot 10^8$ eV/g-cm^2, and consequently the relation between the total ionization ΣI_i in the calorimeter, which is caused by a particle of energy E_0, and E_0 can be defined from the formula $E = 1.54 \cdot 10^6$ eV/g-cm^2 (ΔX) g/cm^2 (1.25), where $dE/dX = 1.54 \cdot 10^6$ eV/g-cm^2 characterizes the ionization losses of the particle in iron. (tr-auth)

15776 (IN-2P3-EC-74(Vol.2), pp 65-124) PHENOMENOLOGICAL INTRODUCTION TO PHOTON HADRON INTERACTIONS. Soeding, P. [nd].

From summer school on particle physics; Gif-sur-Yvette, France (9 Sep 1974).

Distributed by M. S. Detoeuf, IN2P3, 11 rue Pierre et Marie Curie, 75231 Paris Cedex 05.

In summer school on particle physics. Gif-sur-Yvette, 9–21 September 1974. (Institut National de Physique Nucleaire et de Physique des Particules, 75 – Paris (France)).

The experimental investigation of the structures and interactions of hadrons by probing them with photons and electrons is discussed. The lecture was especially concerned with high energy photon hadron interactions, quantum electrodynamics, resonance physics and e^+e^- interactions being left out. Practical methods for polarized photon beams are first discussed: coherent bremsstrahlung from a diamond mono-crystal, acceleration of polarized light, coherent absorption of photons, and polarization properties of photon-hadron interactions then discussed are: pseudoscalar meson photoproduction, measurement of the pion form factor, diffraction of photons and ρ^0 photoproduction, photoproduction of other vector mesons, diffraction on nuclei, shadowing in nuclei, total cross sections for virtual photons and scaling, partons, and hadronic processes by highly virtual photons. (FR)

15777 (IN-2P3-EC-74(Vol.2), pp 125-160) THE PHOTOPRODUCTION AND VECTOR MESON DOMINANCE MODEL. Tran Thanh Van, J. [nd]. (In French)

From summer school on particle physics; Gif-sur-Yvette, France (9 Sep 1974).

Distributed by M. S. Detoeuf, IN2P3, 11 rue Pierre et Marie Curie, 75231 Paris Cedex 05.

In summer school on particle physics. Gif-sur-Yvette, 9–21 September 1974. (Institut National de Physique Nucleaire et de Physique des Particules, 75–Paris (France)).

The various invariance contributions are recalled: (isospin, G parity, natural and nonnatural parity, charge conjugation). The vector meson dominance model is applied to meson production through e^+e^- annihilation and photon-hadron interactions with real photons (π^0 and η photoproduction, diffractive production of vector mesons) and photon-hadron interactions with virtual photons. A qualitative explanation for the various behaviors of the photoproduction cross sections is proposed (charged pion photoproduction, π^0 and eta mesons, and K mesons). (FR)

15778 (IN-2P3-EC-74(Vol.2), pp 195-245) ELECTRON-POSITRON INTERACTIONS. Renard, F. M. [nd]. (In French)

From summer school on particle physics; Gif-sur-Yvette, France (9 Sep 1974).

Distributed by M. S. Detoeuf, IN2P3, 11 rue Pierre et Marie Curie, 75231 Paris Cedex 05.

In summer school on particle physics. Gif-sur-Yvette, 9–21 September 1974. (Institut National de Physique Nucleaire et de Physique des Particules, 75 – Paris (France)).

The problems posed by e^+e^- annihilation are reviewed. In the low energy range ($\sqrt{s} < 1$ GeV) the discussion is concerned with the measurement of the form factor of the pion (analyticity) and interference forms between the ω, ρ, and ϕ amplitudes (renormalization, mixture, vector meson dominance. Mean energies ($1 < \sqrt{s} < 3$ GeV) are the resonance range (including baryon states) and the field for higher vector meson search. At higher energies ($\sqrt{s} > 3$ GeV) the competing is open between models (vector meson dominance model, parton model) not any predicting completely the properties observed. (FR)

15779 (IPNO-CF-75-1, pp 203-231) e^+e^- → HADRONS. Sazdjian, H. [nd]. (In French)

From 6th meeting of the Theoretical Physics Division; Aussois, France (5 Apr 1974).

In proceedings of the sixth meeting of the Theoretical Physics Division. Aussois, 5–10 April 1974. (Paris-11 Univ., 91–Orsay (France). Inst. de Physique Nucleaire).

The main properties of the annihilation process e^+e^- → hadrons are reviewed. In the one photon exchange approximation, the cross section of this process is related to the hadronic part of the vacuum polarization of the photon propagator. The high energy behavior of the cross section can be predicted by various theories, such as the scale invariant theories, the light cone, and the "asymptotically free" theories. They generally predict an asymptotic behavior of the form C/S, where C is a constant and S is the energy squared of the e^+e^- pair in their center of mass system. The experimental results show the asymptotic behavior $\sigma \to$ constant for S → infinite, which contradicts the theoretical predictions. Various explanatory possibilities of the experimental results are examined. (FR)

15780 (ITP-75-97E) SCALING IN e^+e^- ANNIHILATION. Petrov, V. K. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1975. 17p. Dep. NTIS (US Sales Only) $3.50.

Possible reasons for deviations from the Bjorken scaling in processes of e^+e^- annihilation into hadrons are discussed. The fact that these deviations can be described by the same correction function which is true for the processes of deep inelastic lepton-hadron scattering is argued. A senile scaling in e^+e^- annihilation is then caused only by kinematical reasons. The direct calculations show that with a good accuracy this correction function $\sim 1-(q^2/\nu^2)$. (auth)

15781 (LPNHEP-T-74-1) ISOSPIN AMPLITUDE ANALYSIS IN THE CROSS-CHANNEL t OF $\bar{N}N \to \bar{N}N\pi$ REACTIONS AT 5.7 GeV/c. Strachman, Z. (Paris-6 Univ., 75 (France). Lab. de Physique Theorique et Hautes Energies; Paris-6 Univ., 75 (France)). 1974. 118p. (In French). INIS.

A model independent analysis of $\bar{N}N \to \bar{N}(N\pi)$ type reactions is performed in terms of amplitudes of the exchanged isospin I(ex) in the cross-channel t and the isospin.I(πN) of the final (Nπ) system. It provides the modulus and the interferences of the amplitudes as a function of the momentum transfer t and the invariant mass M(πN). The results obtained allow to put in evidence the following main figures of these amplitudes: the behavior of I(ex) = 0 and I(ex) = 1 amplitudes is respectively compatible with a Pomeron and π exchange; the dependence on M(πN) of amplitudes is in reasonable agreement with the πN on mass-shell amplitudes for $I = \frac{1}{2}$ and $I = \frac{3}{2}$ scattering; the resonances $N_\alpha(1490)$ and $N_\beta(1670)$ are produced only by isospin 1 exchange. A good property of factorization for I(ex) = 0 and $I(\pi N) = \frac{1}{2}$: the comparison of the results obtained in different $XN \to X'$ (Nπ) type reactions (where X stands for π, N $\bar{N}$, and carbon) shows that its behavior is independent of the nature of X and of the incident momentum. A phase shift analysis (Regge-model dependent) of the N(1400) shows that its mass dependence is incompatible with a standard Breit-Wigner phase shift. (FR)

15782 (LYCEN-7518) PHOTODISINTEGRATION OF THE DEUTERON. Chetouani, L.; Desgrolard, P.; Hammann, T. F. (Institut d'Etudes Nucleaires, Algiers (Algeria); Lyon-1 Univ., 69 – Villeurbanne (France). Inst. de Physique Nucleaire). Mar 1975. 16p. Dep. NTIS (US Sales Only) $3.50.

An analytical calculation of the total cross section of the $^2H(\gamma,p)n$ reaction at $E_\gamma < 30$ MeV using two realistic nonlocal separable N-N potentials is presented. Exact analytical forms are given for all needed expressions. The results are in satisfactory agreement with the experimental data. The experimental cross section of the inverse process for thermal neutrons is reproduced with 3 to 5% accuracy. The results are found potential dependent. (auth)

15783 SCALING OF $\sigma(e^+e^- \to$ HADRONS) IN ASYMPTOTICALLY NON-FREE THEORIES. Gutbrod, F.; Kerler, W. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Nucl. Phys., B; 96: No. 3, 485-496(29 Sep 1975).

Sigma (e^+e^- → hadrons) is calculated from the Dyson form of the photon self-energy. For the vertex of the elementary constituents the Nakanishi representation is used. A regularization scheme for the Nakanishi spectral function is taken from perturbation theoretic considerations. With simple assumptions about the spectral function, the renormalizability of the theory leads to the asymptotic form σ (e^+e^- → hadrons) approximately const/s. The constant depends on the anomalous dimension of the propagator. The transition to the asymptotic region occurs rather slowly. No jets are expected in the final state and the elementary constituents need not appear in the final state to an appreciable fraction. (NL)

15784 REFINED DETERMINATION OF THE $\eta-\eta'$ MIXING ANGLE AND $\eta \to 2\gamma$ DECAY. Cicogna, G. (Pisa Univ. (Italy). Istituto di Fisica); Strocchi, F. (Istituto Nazionale di Fisica Nucleare, Pisa (Italy)). Phys. Lett., B; 58: No. 3, 313-316 (15 Sep 1975).

A rigorous determination of the $\eta-\eta'$ mixing angle θ is obtained within the SU(3) × SU(3) scheme of Gell-Mann, Oakes and Renner, by carefully taking into account possible contributions due to unequal renormalization constants and possible deviations from the pole dominance of the propagators at zero momentum. The result is $\tan\theta = 0.045 \pm 0.025$. It leads to a determination of $\gamma_{\eta\to 2\gamma}$ in agreement with the recent data and to a value for $\gamma_{\eta'2\eta}$ approximately 10 keV in agreement with other models. (NL)

15785 THE RISE OF ψ PHOTOPRODUCTION. Horn, D. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Service de Physique Theorique). Phys. Lett., B; 58: No. 3, 323-324(15 Sep 1975).

The observed rise of the ψ(3.1) photoproduction cross section is explained in terms of the s-channel mechanism proposed by Aviv Goren Horn and Nussinov. The model leads to a very good fit to the data. (NL)

15786 THE WEIGHT OF THE LIGHT. de Latil, P. Sci. Avenir; No. 338, 320-324(Apr 1975). (In French)

The 1973 experiment at the MIT using the correlated photon emission to demonstrate the material existence of the photon is commented briefly. This discovery would seem to invalidate the expanding universe theory by explaining the recently observed anisotropy of Hubble's constant in terms of a slowing down of the photon interacting with matter. The red shift would be due to what Hubble had called a light fatigue. (FR)

15787 ELECTROMAGNETIC CORRECTIONS TO HADRON SCATTERING. Hamilton, J. (Nordita, Copenhagen). Fortschr. Phys.; 23: No. 4, 211-242(1975).

The review of electromagnetic corrections to hadron scattering includes a survey of the problem and low, medium, and high energies. (JFP)

15788 HADRON ELECTROMAGNETIC STRUCTURE AND HEAVY VECTOR MESONS. Zovko, N. (Univ., Karlsruhe, Ger.). Fortschr. Phys.; 23: No. 4, 185-209(1975).

An attempt is made to summarize the present status of knowledge on hadron form factors, and it is shown that the extended vector meson dominance model supplemented with additional dynamical constraints, provides the most simple scheme which

is able to account for all basic features of analytic form factors. Also some other recent models are touched peripherally. (JFP)

15789 NEW SUM RULE IN ELECTROPRODUCTION. Taha, M. O. (Univ. of Khartoum, Sudan). Lett. Nuovo Cim.; 13: No. 17, 645-648(23 Aug 1975).

A given expansion is used to obtain a sum rule on the scaling function. It is found that this sum rule holds in a previous non-perturbative gauge-invariant model. (JFP)

15790 VECTOR-GLUON DOMINANCE OF e^-e^+ ANNIHILATION. Krolikowski, W. (Univ., Kaiserlautern, Ger.). Bull. Acad. Pol. Sci., Ser. Sci. Math. Astron. Phys.; 23: No. 3, 349-353(Jul 1975).

It is conjectured that the photon has a colored part which is dominated by colored vector gluons. The experimental rise of the Drell ratio for the e^-e^+ annihilation, from $D = 2-3$ at $q^2 = 9$ GeV^2 to $D = 4$ to 7 at $q^2 = 25$ GeV^2, is neatly explained and, at the same time, the agreement with experimental scaling for electroproduction not much spoilt. (auth)

15791 LOW ENERGY ASYMPTOTICS OF FEYNMAN AMPLITUDES. Gerdjikov, V. S. (Inst. of Nuclear Research and Nuclear Energy, Sofia). Bulg. J. Phys.; 2: No. 3, 183-192 (1975). (In Russian)

The mass shell scattering amplitudes $M^{(n)}$ for processes with charged particles and additional emission of n soft photons are analyzed. By means of Feynman diagram technique an asymptotic expansion of $M^{(n)}$ is obtained in the region, where the photons momenta k_i ($i = 1, \ldots, n$) are nearly equal and tend to zero. Besides the explicitly separated pole singularities in k_i, the expansion contains logarithmic and fraction-linear singularities in k_i, weaker than the pole ones. The nonpole singularities depend also on the momenta of the charged particles, on the amplitudes with additional emission of soft quanta from internal charged lines, and on the deviation of the charged particles, momenta from the mass shell, caused by the soft photon emission from the external lines. The leading terms of the nonpole singularities are written explicitly. The expansion is a general formulation of the low energy theorems (LET) in quantum electrodynamics, and agrees with the LET, obtained by Soloviev. This expansion was previously employed in deriving a formula for the S-matrix, in which the explicitly separated pole singularities naturally lead to the well known non-Fock space of asymptotic states. The remaining part of the S-matrix contains no divergences and may be interpreted as the physical scattering amplitude; its behavior at small k_i is determined by the corresponding leading nonpole term. (auth)

15792 EFFECTS OF NUCLEAR SIZE ON THE PHOTOPRODUCTION OF A FERMION PAIR AND A γ RAY. Nadzhafov, I. M. (Azerbaidzhan State Univ., Baku). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 3, 142-146(1975).

From 25th all-union conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1975). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 3, 632-636(1975).

The photoproduction of lepton-antilepton pairs with γ-ray emission in the static field of a nucleus is considered while incorporating the charge form factor, which characterizes the proton distribution. (auth)

15793 SPACE-TIME SPACELESS-TIMELESS INTERACTIONS. Corsiglia, L. (Incol Foundation, Chicago). Int. J. Theor. Phys.; 13: No. 3, 183-187(Jun 1975).

An argument, based on Lorentz invariance for the number of discrete objects and Lorentz noninvariance for continuous physical quantities, is used to arrive at an uncertainty relation involving dipole moment and mass. Applied to a photon, a virtual dipole moment is defined and the photon itself is described as an electromagnetic wave. The small distance singularity in the Coulomb potential is removed by using a complex number for distance. (auth)

15794 SURFACE ELEMENT ON THE LIGHT CONE. Marx, E. (Harry Diamond Labs., Adelphi, MD). Int. J. Theor. Phys.; 13: No. 3, 149-152(Jun 1975).

An explicit form for the vector "surface" element on the light cone in Minkowski space is found by a limiting process from that of a space-like pseudosphere. It is used to discuss more precisely the confinement of the radiation emitted by a charged particle between two light cones. (auth)

15795 NUCLEAR β-DECAY AS A PURELY ELECTRODYNAMIC PHENOMENON. Bagge, E. R. (Kiel Univ. (F.R. Germany). Inst. fuer Reine und Angewandte Kernphysik). Atomkernenergie; 26: No. 1, 70(Aug 1975). (In German)

1 ref.

If the β-decay is regarded as a special case of electron-positron pair creations, a theoretical calculation of the Fermi-g-factor can be made using a purely magnetic electron-neutron interaction without neutrinos. (DE)

15796 β-DECAY OF NUCLEI AS AN ELECTROMAGNETIC PHENOMENON. Bagge, E. R. (Kiel Univ. (F. R. Germany). Inst. fuer Reine und Angewandte Kernphysik). Atomkernenergie; 26: No. 2, 73-75(1975).

3 refs.

It is shown in this paper that Fermi's constant g in his theory of weak interactions can be deduced on the basis of the new concept of β-decay without neutrinos. The theoretically calculated value of g agrees well with that derived from the lifetimes of nuclei. (DE)

15797 SOME MESON COUPLING CONSTANTS IN BROKEN SU(4) AND THE RADIATIVE DECAYS OF ψ AND η_c. Aubrecht II, G.J.; Razmi, M.S.K. (Institute of Theoretical Science and Department of Physics, University of Oregon, Eugene, Oregon 97403). Phys. Rev. D 12: No. 7, 2120-2123 (1 Oct 1975).

We calculate vector-pseudoscalar-pseudoscalar and vector-vector-pseudoscalar coupling constants in broken SU(4) using current algebra and partial conservation of the axial-vector current. As applications of our results, estimates of the decay widths $\Gamma(\psi \to X^0\gamma)$, $\Gamma(\psi \to \eta_c\gamma)$, and $\Gamma(\eta_c \to 2\gamma)$ are presented. (auth)

15798 MULTIPLE COMPTON SCATTERING IN THE FORWARD DIRECTION. Ram, M. (Department of Physics, State University of New York, Buffalo, New York 14214). Phys. Rev. D 12: No. 7, 2043-2048 (1 Oct 1975).

We prove that, to lowest order in α, the amplitude for the reaction $\gamma + e \to n\gamma + e$, where $n = 2,3,4,\ldots$, vanishes when all n final photons have momenta parallel to that of the incident photon. We generalize this result to scalar electrodynamics, to the scattering of massless pseudoscalar (scalar) mesons off massive fermions, and to the scattering of massless scalar mesons off massive scalar mesons. (auth)

15799 GRAVITATIONAL CORRECTIONS TO LEPTON-LEPTON COULOMB SCATTERING. Grisaru, M.T.; van Nieuwenhuizen, P.; Wu, C.C. (Department of Physics, Brandeis University, Waltham, Massachusetts 02154). Phys. Rev. D 12: No. 6, 1813-1819 (15 Sept 1975).

The contributions of order $e^2\kappa^2$ to the scattering of two electrically charged nonidentical fermions are evaluated. The corrections to the graviton-fermion vertex are finite, and those to the photon-fermion vertex diverge, while the sum of all ultraviolet divergences is proportional to the Born amplitude. No infrared divergences are present in the cross section. The scalar-photon–graviton system is also investigated, with similar conclusions. (auth)

15800 IMPROVED UPPER LIMIT ON THE PHOTON REST MASS. Barnes, A.; Scargle, J.D. (Theoretical Studies Branch, Ames Research Center, National Aeronautics and Space Administration, Moffett Field, California 94035). Phys. Rev. Lett. 35: No. 17, 1117-1120 (27 Oct 1975).

By standard arguments, observed hydromagnetic waves in the Crab Nebula imply an upper limit to the photon rest mass of $\mu \lesssim 10^{-16} - 10^{-15}$ cm^{-1}, $m_{ph} \lesssim 3 \times 10^{-54} - 3 \times 10^{-53}$ g (uncertainty < factor 100), smaller than the previous best limits by a factor $10^4 - 10^5$. However, the standard wave arguments used here and elsewhere are reexamined and found not to be rigorous, although the limits given are probably valid in order of magnitude. (auth)

15801 NEW NARROW RESONANCES AND SEPARATE LOCALIZATION OF ORDINARY AND COLOR SU(3). Greenberg, O.W. (Department of Physics and Astronomy, Center for Theoretical Physics, University of Maryland, College Park, Maryland 20742). Phys. Rev. Lett. 35: No. 17, 1120-1123 (27 Oct 1975).

I interpret ψ (3095) and ψ' (3684) as space and color excitations in a model in which a quark is a composite of a Fermi, spin$-1/2$, ordinary SU(3) object and a Bose, spin-0, color SU(3) object, and a meson is a four-body object. Color conservation and the absence of dipole transitions from the space mode make these two ψ's narrow for nonradiative and for radiative decays, respectively, to the usual hadrons. (auth)

15802 KINEMATIC CONSTRAINTS ON THE PRODUCTION OF MAGNETIC MONOPOLES. Wilson, L.W. (Department of Physics, University of California, Berkeley, California 94720). Phys. Rev. Lett. 35: No. 17, 1126-1128 (27 Oct 1975).

A lower limit for the lab energy of a magnetic monopole produced from a stationary target is derived and used to study implications of the data of Price *et al.* (auth)

15803 INCLUSIVE TRIDENT ELECTROPRODUCTION AS A TEST OF PARTON MODEL AND BILOCAL ALGEBRA. Pandita, P.N. (Department of Physics, Kashmir University, Srinagar 190006, Kashmir, India). Phys. Rev. D 12: No. 7, 2090-2100 (1 Oct 1975).

We analyze deep-inelastic trident production, $e+p \to e+\mu^+\mu^-+$ anything, in the approprate scaling region, assuming the validity of the parton model and the bilocal algebra. It is shown that the measurement

of the difference between the scaling inclusive trident cross section of the electron and that of the positron will allow the determination of a proton structure function $V(x)$, which involves the cube of the parton charges, in unexplored kinematic regions. This structure function obeys an exact sum rule, independent of the momentum distribution of partons; the sum rule therefore holds for nuclear targets as well. Since $V(x)$ is related to odd-charge-conjugation exchanges in the t channel, the Pomeranchukon and other C-even contributions are not present, so that $V(x)$ should have a readily integrable quasielastic peak. In the light-cone approach the same difference of cross sections measures the symmetric function $S_{Q3}(\eta)$, which cannot be obtained from electroproduction and neutrino-induced-production data. So far as scaling is concerned, the two approaches seem to give similar results. (auth)

15804 $\gamma\gamma$ SCATTERING AT HIGH ENERGY. Evans, K.J.; Landshoff, P.V.; Polkinghorne, J.C. (Department of Applied Mathematics and Theoretical Physics, University of Cambridge, England). Phys. Rev. D 12: No. 7, 2082-2089 (1 Oct 1975).

It is shown how fixed poles enable the Pomeron to couple in $\gamma\gamma$ scattering, and to produce the expected asymptotic factorization $\sigma_{\gamma\gamma} \sim \sigma_{\gamma p}^2 / \sigma_{pp}$. Five of the eight independent invariant amplitudes contain a double fixed pole, but when these amplitudes are combined to form the t-channel helicity amplitudes the double poles cancel, leaving single fixed poles at $j = 1$, which are what is needed to cancel nonsense factors. (auth)

15805 FIREBALLS IN THE MASS REGION OF THE g MESON. Meggs, W.J. (Vanier College, Snowdon Campus, 5160 Decarie Boulevard, Montreal, Quebec, H3X 2H9, Canada). Phys. Rev. D 12: No. 7, 1936-1939 (1 Oct 1975).

Threshold enhancements predicted by the statistical bootstrap for the $\rho\rho$ and $A_2\pi$ channels in the region of the g meson account for the observed signal in these channels, but do not explain the strong g (1680) signal seen in the $\pi\pi$ channel. We conclude that the g meson decays principally into the $\pi\pi$ channel, and hence belongs to that small class of particles which have a preferred decay mode in violation of the statistical bootstrap. Other examples of the phenomenon are given, and a dynamical scheme which incorporates these exceptional decays is outlined. (auth)

15806 ESTIMATE OF THE RATE OF THE RARE DECAY $\pi^0 \to 3\gamma$. Dicus, D.A. (Center for Particle Theory, Department of Physics, The University of Texas, Austin, Texas 78712). Phys. Rev. D 12: No. 7, 2133-2136 (1 Oct 1975).

An estimate is given for the decay rate of the neutral pion into three photons by using a single quark loop in a model with parity violation. (auth)

15807 SU(6) STRONG BREAKING: STRUCTURE FUNCTIONS, AND STATIC PROPERTIES OF THE NUCLEON. Le Yaouanc, A.; Oliver, L.; Pène, O.; Raynal, J. (Laboratoire de Physique Théorique et Hautes Energies, Université de Paris-Sud, 91405 Orsay, France). Phys. Rev. D 12: No. 7, 2137-2156 (1 Oct 1975).

In order to explain the experimental x behavior of the ratio of deep-inelastic scattering structure functions F_2^{en}/F_2^{ep}, which is a manifestation of SU(6) breaking, we propose to introduce, in the harmonic-oscillator quark model, the following interband mixing for the nucleon wave function *at rest:* $\cos\varphi\,(\underline{56},0^+)_{N=0} + \sin\varphi\,(70,0^+)_{N=1}$. The effect on the x behavior of the ratio F_2^{en}/F_2^{ep} is linear in $\tan\phi$; the angle is found to be $\varphi \simeq -20°$. It turns out that the famous successes of unbroken SU(6) for the low-lying-octet static properties are not broken significantly, $\mu_p^{tot}/\mu_n^{tot} \simeq -3(1+0.03)/2$, $(F/D)_{\text{axial-vector}} \simeq 2(1+0.02)/3$, since the breaking effect is proportional to $\tan^2\varphi$ with reducing coefficients. Moreover, the mixing implies a slope for the neutron electric form factor, which is a linear effect in $\tan\varphi$, of the right *sign* and order of magnitude. $|G_A/G_V|$ is correctly predicted to be 1.25. The chiral configuration mixing describing the nucleon wave function at $P_z = \infty$ is shown to come from the combination of two effects: (i) introduction of small components in the quark Dirac spinors to account for the highly relativistic internal quark velocities as described in our previous papers, which preserves the $\underline{56}$ assignment of the nucleon wave function at rest, and (ii) the new effect of SU(6) mixing for the nucleon wave function at rest. Introducing a structure for the quarks which parallels the need for quark structure in the leptoproduction of hadrons, we end with a good description of the unpolarized structure functions in deep-inelastic electro- and neutrino-production. Further predictions are made of the yet-unmeasured asymmetries in deep-inelastic polarized electroproduction. Careful comparison is made with previous works by Altarelli *et al.* and Close, who have adopted different approaches. (auth)

15808 HARD-PION PRODUCTION IN e^+e^- ANNIHILATION. Raval, V.M. (Department of Physics, Indian Institute of Technology, Kanpur, India). Phys. Rev. D 12: No. 7, 2157-2160 (1 Oct 1975).

Partial conservation of axial-vector current and current-algebra ideas are used to study hard-pion production in the e^+e^- annihilation process in the Bjorken-Johnson-Low limit. It turns out that information is provided on high-energy parameters appearing in the operator-product expansion of $A_\mu(x)\,A_\nu(0)$ and $V_\mu(x)\,V_\nu(0)$. This, in turn, leads to some useful results. Specifically, direct experimental determination of the isovector part of the ratio R seems possible. (auth)

15809 γ-RAY-CASCADE DECAYS FROM ψ' (3684) TO ψ (3095). Feldman, G.J.; Gilman, F.J. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). Phys. Rev. D 12: No. 7, 2161-2163 (1 Oct 1975).

The consequences of the existence of the γ-ray-cascade decay, ψ' (3684) $\to \gamma + X$ and $X \to \gamma + \psi$ (3095), are examined. The kinematics of the resulting 2γ mass spectrum together with the observed dynamics of the neutral missing mass in ψ' (3684) $\to \psi$ (3095) + neutrals are shown to be of such a form that a stringent upper limit can be placed on the sum of all such transitions. (auth)

15810 NONLEAKAGE OF QUARK CHARGE MOMENTS IN SEQUENTIAL FRAGMENTATION MODELS. Novoseller, D. (California Institute of Technology, Pasadena, California 91109). Phys. Rev. D 12: No. 7, 2172-2175 (1 Oct 1975).

Simple sequential fragmentation models for deep-inelastic processes may be tested by comparing powers of the total charge in the quark fragmentation region and adjoining plateau, without reference to the mechanism for producing hadrons from quarks. (auth)

Weak

15811 (GIFT-8/75) WEAK INTERACTIONS. Pascual, R. (Grupo Interuniversitario de Fisica Teorica de Altas Energias (GIFT), Zaragoza (Spain)). 1975. 93p. (In Spanish). Dep. NTIS (US Sales Only) $5.00.

The notes of a course given on classical or Fermi-Cabibbo weak interactions are presented. The topics considered are lepton processes, semilepton processes with $\Delta Y = 0$, semilepton processes with $\Delta Y \neq 0$, and nonlepton processes. (JSR)

15812 (JUL-Conf-13, pp 91-105) SOME REMARKS ON PARITY VIOLATING EFFECTS OF INTRAMOLECULAR INTERACTIONS. Rein, D. W. (Technischen Hochschule, Aachen). Nov 1974.

From international symposium on generation and amplification of asymmetry in chemical systems; Juelich, F. R. Germany (24 Sep 1973).

In international symposium on generation and amplification of asymmetry in chemical systems. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany)).

The role of the parity-violating weak interaction in atomic and molecular physics is pursued. Parity-violating forces do in fact distinguish between molecular configurations which are identical up to a space reflection, as is assumed to be the case for optical isomers. The corrections to the binding energies of such molecules are, however, tiny. In conventional weak interaction theory this is due to the gauge invariance of the photon mediating electromagnetic forces between electrons and electrons and between electrons and nucleons. The constraint of gauge invariance does not allow for long-range parity-violating forces of first order in the weak-coupling constant G. This implies that parity-violating effects in atoms or molecules are suppressed, not only by a factor of $\lesssim 10^{-5}$ due to the smallness of the weak-coupling constant, but also by the ratio of the range of parity-violating forces divided by the average extension of the electron cloud, which is in addition at most of order $\lesssim 10^{-5}$. Therefore, no appreciable energy difference between optical isomers is expected within the framework of conventional weak interaction. (auth)

15813 (JUL-Conf-13, pp 449-469) NEUTRAL CURRENTS IN WEAK INTERACTIONS AND MOLECULAR ASYMMETRY. Garay, A. S.; Hrasko, P. (Biological Research Center, Szeged). Nov 1974.

From international symposium on generation and amplification of asymmetry in chemical systems; Juelich, F. R. Germany (24 Sep 1973).

In international symposium on generation and amplification of asymmetry in chemical systems. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany)).

Weak interactions are parity-violating forces, i.e. they differentiate between mirror images. It is, therefore, a very attractive hypothesis to invoke weak interactions in explaining the origin of molecular asymmetry. It is, however, not clear whether weak interactions may operate between electrons and/or between electrons and protons. For these types of interactions so-called neutral currents are needed. Recent experiments with muon neutrinos at CERN gave some evidence for the existence of neutral currents. Thus, parity-violating forces may be supposed active in molecules. In the first part of this paper a very elementary theory of weak interactions is outlined with special reference to the discovery of neutral currents. In the second part it is shown how weak interactions may differentiate between mirror image molecules. The asymmetrically distributed static

charges in chiral molecules represent a helical potential field. This helical potential field may exert an effect on the orbital electrons and, therefore, coupling of spins and momenta occurs. Thus, the enantiomers are parity-transformed images not only as geometrical bodies, but their orbital electrons are parity transformed also as "a helical electron gas". Weak interactions will differentiate between L and D forms because their orbital electrons have a nonzero spin polarization with respect to their velocity. (2 figures) (auth)

15814 (ORO-242) LEPTON SCATTERING AND THE SLOPE OF THE REGGE TRAJECTORY IN AN $SU_2 \times SU_2 \times U_1$ GAUGE THEORY. Dicus, D. A.; Teplitz, V. L.; Young, J. E. (Texas Univ., Austin (USA). Center for Particle Theory). Dec 1975. Contract AT(11-1)-3069. 11p. Dep. NTIS $3.50.

One considers again an $SU_2 \times SU_2 \times U_1$ gauge theory in which the left-handed leptons (e, nu/sub e/, mu, nu/sub mu/) are in a quartet representation. The model is motivated by requiring duality in its Regge region. One checks that the energy of the Regge region is high but not absurd so that the slopes of the trajectories are not so small as to make the Regge recurrence region forever inaccessible. One also revises the prediction for nu/sub e/e elastic scattering. (auth)

15815 RESIDUE SUM RULES FOR INELASTIC (ANTI) NEUTRINO NUCLEON SCATTERING. Ward, B. F. L. (Stanford Linear Accelerator Center, Calif. (USA)). Nucl. Phys., B; 96: No. 3, 462-484(29 Sep 1975).

The complete set of current algebra sum rules for the Regge residues and asymptotic constant S limits of the structure functions of inelastic (anti) neutrino nucleon scattering are discussed. (NL)

15816 WEAK EFFECTS IN $e^+e^- \rightarrow e^+e^-$. Budny, R. (Stanford Univ., Calif. (USA). Inst. of Theoretical Physics). Phys. Lett., B; 58: No. 3, 338-340(15 Sep 1975).

The prediction for the cross section of $e^+e^- \rightarrow e^+e^-$ is given, assuming one photon and W^0 exchange. Pure W^0 terms and transverse and longitudinal beam polarizations are included. (NL)

15817 TOPICS IN GAUGE THEORIES. Joglekar, S. D. Stony Brook, NY; State Univ. of New York (1975). 293p. University Microfilms Order No. 75-24,630.

Thesis (Ph. D.).

All of the interaction Lagrangian and relations among the masses and coupling constants of the Weinberg model are obtained. The recently developed technique of Ward Takahashi identities for proper vertices in gauge theories is applied to the problem of renormalization of electrodynamics. Finally, the K/sub L/-K/sub S/ mass difference and many rare decay modes of K mesons are discussed in a phenomenological unified gauge model of strong, electromagnetic and weak interactions. (Diss. Abstr. Int., B)

15818 INDUCED SINGULARITIES OF MASS DISTRIBUTIONS OF UNSTABLE PARTICLES CONNECTED WITH CASCADE DECAY AND THE CP-PROBLEM. Khalfin, L. A. (Leningrad Branch of Mathematical Inst.). Teor. Mat. Fiz.; 25: No. 2, 260-264(Nov 1975). (In Russian).

On the basis of the strong energy-momentum conservation law, the induced singularities of mass distributions of unstable particles connected with cascade decay are investigated. The possible solution of the CP-problem in the decay of K^0-$\bar{K}^0$ mesons based on the mechanism of the induced singularities is proposed. (auth)

15819 NEUTRAL HEAVY LEPTONS AS A SOURCE FOR DIMUON EVENTS: A CRITERION. Pais, A.; Treiman, S.B. (Brookhaven National Laboratory, Upton, New York 11973). Phys. Rev. Lett. 35: No. 18, 1206-1207 (3 Nov 1975).

Suppose that a neutral, heavy, spin-1/2 lepton were created by a mixed neutrino-antineutrino beam incident on an arbitrary target and that this lepton subsequently decayed into a μ pair and a neutrino (or antineutrino). Then the ratio of the respective mean laboratory energies for the μ^- and μ^+ lies between 0.48 and 2.10. (auth)

15820 DECAY MODES OF THE MESON η' (958) AND CHIRAL-SYMMETRY BREAKING. Singh, C.A.; Pasupathy, J. (Tata Institute of Fundamental Research, Bombay 400005, India). Phys. Rev. Lett. 35: No. 18, 1193-1195 (3 Nov 1975).

Using the simple model that the amplitude for $\eta' \rightarrow \eta\pi\pi$ is dominated by the δ (970) resonance we find a satisfactory fit to the data. The quadratic mass formula for η-η' mixing with a positive mixing angle (i.e. reduction of $s\bar{s}$ content in the physical η state) is preferred in agreement with the requirement for $\eta' \rightarrow 2\gamma$. Failure of the current-algebra calculation for $\eta' \rightarrow \eta\pi\pi$ is explained and is shown *not* to be evidence against the $(3^*,3) \oplus (3,3^*)$ model of chiral-symmetry breaking. (auth)

15821 ASSOCIATED PRODUCTION BY WEAK CHARGED AND NEUTRAL CURRENTS. Shrock, R.E. (Joseph Henry Laboratories, Princeton University, Princeton, New Jersey 08540). Phys. Rev. D 12: No. 7, 2049-2059 (1 Oct 1975).

Cross-section estimates are presented for the charged- and neutral-current associated-production reactions $\nu_\mu N \rightarrow l K \Lambda$ and $\nu_\mu N \rightarrow l K \Sigma$, where $l = \mu$ or ν_μ, respectively. The neutral-current reactions are considered within the framework of the Weinberg-Salam theory and theories in which the hadronic neutral current is proportional to the electromagnetic current. The calculations are performed using the Born approximation for the range of incident neutrino energies relevant for present experiments, from threshold to 3 GeV. We find flux-averaged cross sections much smaller than those indicated by preliminary Argonne data. Finally, calculations of the longitudinal polarization of the hyperons are presented. (auth)

15822 LEPTON $g-2$ IN A DUAL GAUGE MODEL. Dicus, D.A. (Center for Particle Theory, Department of Physics, The University of Texas, Austin, Texas 78712). Phys. Rev. D 12: No. 7, 2176-2177 (1 Oct 1975).

The weak correction to the lepton's magnetic moment is calculated in a gauge model which exhibits a form of duality. (auth)

15823 NONLEPTONIC DECAYS OF CHARMED MESONS: IMPLICATIONS FOR e^+e^- ANNIHILATION. Einhorn, M.B.; Quigg, C. (Fermi National Accelerator Laboratory, Batavia, Illinois 60510). Phys. Rev. D 12: No. 7, 2015-2030 (1 Oct 1975).

Using a generalization of the $|\Delta I| = 1/2$ rule, we analyze the nonleptonic weak decays of pseudoscalar charmed mesons. We call attention to the likelihood that the dominant decays will be into many-body channels. Special attention is devoted to the properties of charmed final states just above charm threshold in e^+e^- annihilation. The questions of charged multiplicity, copious kaon production, and energy carried by neutrals are explored. (auth)

Strong (General)

Refer also to abstracts 15868, 15873, 16194, and 16198.

15824 (SLAC-188) QUARKS AND BUBBLES: THE DYNAMICS OF A FIELD THEORY MODEL OF HADRON STRUCTURE. Giles, R. C. III. (Stanford Linear Accelerator Center, Calif. (USA)). Nov 1975. Contract E(04-3)-515. 103p. Dep. NTIS $5.50.

The semi-classical dynamics of the field theory model of hadron structure proposed by Bardeen, Chanowitz, Drell, Weinstein, and Yan (BCDWY) is analyzed. The BCDWY model is based on a field theory of quarks interacting via the Yukawa coupling with a quartically self-coupled scalar field which acquires a nonzero vacuum expectation value. BCDWY have shown that in a strong coupling limit, though the quark acquires a large dynamically generated bare mass, low mass particle-like bound states containing quarks ("bubbles") can form. (JFP)

15825 DISPERSION OF THE MULTIPLICITY DISTRIBUTION IN HADRON-NUCLEUS COLLISIONS. Bialas, A.; Czyz, W. (Uniwersytet Jagiellonski, Krakow (Poland). Instytut Fizyki). Phys. Lett., B; 58: No. 3, 325-327(15 Sep 1975).

It is argued that the measurements of the dispersion of the multiplicity distribution in hadron-nucleus collisions favor the processes of particle production in a sequence of collisions of the incident hadron with target nucleons. On the other hand, generation of particles on groups of nucleons treated as single units leads to large discrepancies. (NL)

15826 NEW AMPLITUDES FOR DATA ANALYSIS. Worden, R. P. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Phys., B; 96: No. 3, 509-514(29 Sep 1975).

Sets of quasi two-body amplitudes are proposed which express the results of an amplitude analysis concisely, and are very simply related to helicity amplitudes. They are particularly suited to meson-baryon scattering with a polarized target or polarization-analyzing baryon decay. In this case they can be used to give optimal bounds on moduli and relative phases of helicity amplitudes. (NL)

15827 DYNAMICAL MODEL FOR DIFFRACTION, SCATTERING, AND PRODUCTION IN STRONG INTERACTIONS. Hedinger, R. A. Cincinnati; Univ. of Cincinnati (1975). 74p. University Microfilms Order No. 75-25,910.

Thesis (Ph. D.).

A multi-Regge model including isotopic spin and G-parity conservation with exchange degenerate secondary trajectories is investigated. Neglecting the triple Pomeranchuk coupling one obtains a bootstrap of exchange degenerate trajectory intercepts at alpha/sub i/(0) equals $\frac{1}{2}$ plus the Pomeranchuk trajectory. Multiplicity moments and trajectory slopes are calculated. The ratio of the slopes of the Pomeranchuk and f trajectories can only be reconciled with observations if the spin-flip nature of rho exchange is taken into account. (Diss. Abstr. Int., B)

15828 MASSES AND OTHER PARAMETERS OF THE LIGHT HADRONS. DeGrand, T.; Jaffe, R.L.; Johnson, K.; Kiskis, J. (Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). Phys. Rev. D 12: No. 7, 2060-2076 (1 Oct 1975).

The masses and static parameters of the light hadrons (the pseudoscalar and vector meson nonets and the baryon octet and decuplet) are calculated using the bag model. The effects of quark kinetic energy, bag energy, strange-quark mass, colored-gluon exchange in lowest order, and energy associated with certain quantum fluctuations are included. These are parameterized by four constants which have fundamental significance and do not change from multiplet to multiplet. The fit to the spectrum is good. The ordering of all the states is given correctly. The intramultiplet splittings are very accurate for the baryon decuplet and reasonably good for the other multiplets. The isosinglet pseudoscalar mesons η and η' are treated separately in light of the special role that gluon intermediate states play in these states. Magnetic moments, weak decay constants, and charge radii are calculated. Where comparison with experiment is possible, we generally obtain improvement over the naive quark model. It is shown that exotic baryons do not exist as narrow resonances in this approximation to the bag theory. (auth)

15829 RELATIVISTIC QUASIPOTENTIAL CALCULATION OF QUARK-MODEL MESON MASSES. Jhung, K.S.; Chung, K.H.; Willey, R.S. (Department of Physics, University of Pittsburgh, Pittsburgh, Pennsylvania 15260). Phys. Rev. D 12: No. 7, 1999-2001 (1 Oct 1975).

Relativistic calculations of the $L = 0$ energy levels of a $q\bar{q}$ pair bound by a linear potential are done both for light quarks (the ρ system) and heavy quarks (charmonium). (auth)

15830 NONSTRANGE QUARK MASS IN THE BAG MODEL. Golowich, E. (Department of Physics and Astronomy, University of Massachusetts, Amherst, Massachusetts 01002). Phys. Rev. D 12: No. 7, 2108-2112 (1 Oct 1975).

The MIT bag model of the nucleon is extended to include the effect of finite nonstrange quark mass. If the nucleon axial-vector coupling constant is used to fix the quark mass, then using $g_A = 1.25$ we find $m = 122$ MeV for the mass of the degenerate up and down quarks. Other attributes of the nucleon are evaluated in this model and the limiting case of infinite quark mass is studied as a check on the calculation. (auth)

15831 QUANTUM-NUMBER EXCHANGES AT EXTREMELY HIGH ENERGIES. McCoy, B.M. (Institute for Theoretical Physics, State University of New York at Stony Brook, Stony Brook, New York 11794); Tsun Wu, T. Phys. Rev. Lett. 35: No. 18, 1190-1192 (3 Nov 1975).

We study systematically the high-energy behavior of backward Compton scattering and pair annihilation in massive quantum electrodynamics. For both of these processes (where a fermion is exchanged), we find, in the complex angular-momentum plane, a fixed cut with a simple pole coming out at a physical value of momentum transfer. These results are used to discuss possible behaviors, at extremely high energies, of hadronic processes with the exchange of quantum numbers. (auth)

Strong (Baryon No. = 0)

15832 (ITP-75-49E) IMPROVED AXIOMATIC RESTRICTIONS ON FORM FACTORS AND SCATTERING AMPLITUDES OF HADRONS. Kelemen, V. I.; Lomsadze, Yu. M. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1975. 27p. Dep. NTIS (US Sales Only) $4.00.

The axiomatic local restrictions obtained earlier on the electromagnetic form factors of hadrons are improved. The improved restrictions contain a segment of the physical region of the scattering channel which can be chosen at one's will. The way of giving a greater flexibility to whatever the axiomatic restrictions both on the electromagnetic form factors and the scattering amplitudes of hadrons is pointed out. At last, it is shown how to extend some of the earlier obtained inequalities for the forward scattering amplitudes onto the general case $t \neq 0$. (auth)

15833 (RL-75-147) MODELS FOR THE PRODUCTION OF NEW PARTICLES IN PHOTON AND HADRON COLLISIONS. Sivers, D.; Goldman, T. (Science Research Council, Chilton (UK). Rutherford Lab.). Sep 1975. 14p. Dep. NTIS (US Sales Only) $3.50.

Some general features of models for the production of $\psi(3095)$ and the comparison with data supports the hadronic nature of the ψ are discussed. The implications of the data on ψ production for the cross section of charmed particle production is pointed out. (auth)

15834 LOWER BOUNDS TO THE $I = 0$, $I = 2\pi\pi$ S-WAVE SCATTERING LENGTHS. Lopez, C.; Mennessier, G. (Paris-6 Univ., 75 (France). Lab. de Physique Theorique et Hautes Energies). Nucl. Phys., B; 96: No. 3, 515-524(29 Sep 1975).

Roy's exact partial wave equations allow one to find bounds for any linear combination of the isospin $I = 0$ and 2 s-wave scattering lengths, with positive coefficients. The bound is a function of the quantity $a_D = a_0^0 + a_2^2$, where a_1^1 are the D-wave scattering lengths. Thus, on the (a_0^0, a_2^2) plane, an allowed domain whose boundary is fairly close to the phenomenological region can be drawn. For a value of $a_D = 1.7 \times 10^{-3}$, the following particular bounds are found: $a_0^0 \geq -0.49$, $a_2^2 \geq -0.29$. (NL)

15835 CHARM: AN INTERPRETATION OF NEW PARTICLES. Paty, M. Recherche (Paris); 6: No. 56, 466-468(May 1975). (In French)

The paradoxical combination in the new Ψ particles of heaviness (3.1, 3.7, and 4.2 GeV) and narrowness has led to the introduction of a new quantum number, charm, in a four-quark model including charmed particles: mesons and baryons. (FR)

15836 STRONG-GRAVITY BOUND QUARK–ANTIQUARK PAIRS AND MESON MASS SPECTRUM. Chhajlany, S. C.; Kumar, N. (Univ., Leige). Lett. Nuovo Cim.; 13: No. 17, 649-652(23 Aug 1975).

The problem of quantization of the internal excitations of charged self-gravitating matter was considered previously. It was found that the resulting energy spectrum could adequately account for the known lepton masses. This approach is explored in the context of hadrons. The viewpoint is adopted that the hadrons are composite objects with quarks as constituents. More specifically, one first takes up the case of mesons which are made up of appropriate quark–antiquark pairs. The psi particles are also considered. The central idea is that the assumption of strong-gravity dominance at small distances taken in conjunction with the equivalence principle, leads to an effective potential whose bound states appear as physical particles. (JFP)

15837 CORRECTIONS TO THE GELL-MANN–OKUBO FORMULA DUE TO SECOND-ORDER SU(4) BREAKING. Simard, R.; Suzuki, M. (Lawrence Berkeley Laboratory and Department of Physics, University of California, Berkeley, California 94720). Phys. Rev. D 12: No. 7, 2002-2006 (1 Oct 1975).

It is shown by a current-algebra technique that second-order SU(4)-breaking effects shift the charmed-vector-meson masses upwards from the values predicted by the quadratic Gell-Mann–Okubo formula. The magnitude of the shift is estimated in a simple quark model of meson coupling constants. (auth)

15838 MESON MASS FORMULA FROM DUALITY. Frampton, P.H. (Department of Physics, Syracuse University, Syracuse, New York 13210). Phys. Rev. D 12: No. 7, 2164-2165 (1 Oct 1975).

A general mass formula for meson levels in the symmetric-group dual resonance model is written in terms of the corresponding quark-model quantum numbers. (auth)

Strong (Baryon No. = 1)

15839 (IC-74-128) CURRENT ALGEBRA AND THE LOW ENERGY πN SCATTERING AMPLITUDES. Nath, L. M.; Sarker, A. Q. (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1974. 19p. INIS.

20 refs., 3 tables.

The low energy pion-nucleon scattering is discussed using the current algebra constraints on the scattering amplitudes. In order to estimate the on-mass-shell amplitudes, the "remainder terms" are calculated as a sum over the contribution from $\Delta(1236)$, $N^*(1525)$ and $N^*(1470)$ with particular emphasis on the correct evaluation of the off-mass-shell effects of spin-$\frac{3}{2}$ resonances. The invariant amplitudes are expanded in powers of ν and ν_B form small values of these variables. The expansion coefficients are calculated explicitly and compared with experiment. (auth)

15840 (IC-74-131) SCATTERING LENGTHS AND EFFECTIVE RANGES IN LOW-ENERGY πN SCATTERING. Haider, Q.; Nath, L. M.; Sarker, A. Q. (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1974. 8p. INIS.

2 tables.

The S- and P-wave scattering lengths and the S-wave effective ranges for the low energy πN scattering are calculated by using a model based on the current algebra constraints on the scattering amplitudes, involving the "remainder terms" which are saturated with contributions from the resonances. The predictions from this model are in good agreement with the experiment. (auth)

15841 (LBL-3628) DETAILS OF FORMALISM OF a + b yields 1 + 2 + 3 INCLUDING SUBENERGY UNITARITY. Goradia, Y.

(California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Aug 1975. Contract W-7405-ENG-48. 59p. Dep. NTIS $5.50.

A formalism to include subenergy unitarity in a + b yields 1 + 2 + 3 was presented earlier by Goradia and Lasinski. One discussed the details of this formalism and its application to pi N yields pi pi N. (auth)

15842 GEOMETRICAL SCALING AND THE QUARK MODEL IN ELASTIC Kp, πp AND pp SCATTERING. Froeyland, J. (Oslo Univ. (Norway). Fysisk Institutt). Phys. Lett., B; 58: No. 3, 317-318(15 Sep 1975).

By combining the idea of geometrical scaling with the naive quark model a very simple connection between high energy Kp, πp and pp elastic scattering is arrived at. (NL)

15843 THE GEOMETRICAL POMERON AND ITS INFLUENCE ON THE ANALYSIS OF LOW ENERGY DATA. Froeyland, J.; Hoegaasen, H. (Oslo Univ. (Norway). Fysisk Institutt). Phys. Lett., B; 58: No. 3, 319-322(15 Sep 1975).

It is shown that the idea of geometric scaling formulated as a scaling property of the orbital angular momentum is very fruitful, not only at high but also at medium (and low) energies. (NL)

15844 REAL PARTS OF πN FORWARD AMPLITUDES AT HIGH ENERGIES. Hoehler, G.; Jakob, H. P.; Kaiser, F. (Karlsruhe Univ. (TH) (F. R. Germany). Inst. fuer Theoretische Kernphysik). Phys. Lett., B; 58: No. 3, 348-354(15 Sep 1975).

Since predictions from high energy cross sections alone are not reliable, real parts above 10 GeV/c have been calculated from dispersion relations, using the most recent data and a simplified method. (NL)

15845 THE IMAGINARY PART OF THE HELICITY NON-FLIP C = −1 EXCHANGE AMPLITUDES IN ELASTIC SCATTERING BETWEEN 6 AND 14 GeV. Carnegie, R. K.; Cashmore, R. J.; Davier, M.; Leith, D. W. G. S.; Walden, P.; Williams, S. H. (Stanford Linear Accelerator Center, Calif. (USA)). Phys. Lett., B; 58: No. 3, 371-375(15 Sep 1975).

Using accurate data on the differential cross sections for elastic scattering of particles and antiparticles on protons from 6 to 14 GeV, the projection of the C = −1 exchange amplitude onto the dominant diffractive amplitude is measured. Strong peripherality in impact parameter space is observed for all the measured amplitudes with peak values scaling with the interaction radius. The zero of the imaginary part of the C = −1 exchange amplitude in K^+p scattering moves to smaller t values as the energy increases from 6 to 14 GeV. The p^+p exchange amplitude is more peripheral than the π^+p and K^+p counterparts and an unexpected energy dependence is observed. (NL)

15846 UNNATURAL PARITY EXCHANGE IN pi^+p yields (rho, omega) $DELTA^{++}$. Owens, J. F.; Eisner, R. L. (Case Western Reserve Univ., Cleveland, Ohio (USA)); Chung, S. U.; Protopopescu, S. D. (Brookhaven National Lab., Upton, N. Y. (USA)). Phys. Lett., B; 58: No. 3, 376-380(15 Sep 1975).

The magnitudes and relative phases of the unnatural parity exchange amplitudes in pi^+p yields (rho^0, omega) $DELTA^{++}$ are determined at 7.1 GeV/c using a model dependent amplitude analysis technique. (NL)

15847 LOW ENERGY PION–NUCLEON PHENOMENOLOGY WITH INTERIOR DISPERSION RELATIONS. Moir, D. C. Tempe, AZ; Arizona State Univ. (1975). 87p. University Microfilms Order No. 75-25,375.

Thesis (Ph. D.).

The interior dispersion relation (IDR) calculation of the sigma-term by Hite and Jacob is redone with attention given to uncertainties in the input partial wave amplitudes. In addition, the IDR technique is extended to calculate the S-wave scattering lengths. The results indicate that this new independent dispersion technique is consistent with other dispersion relation calculations; however, IDR offers many advantages not available in conventional methods. (Diss. Abstr. Int., B)

15848 EXCLUSIVE AND INCLUSIVE REACTIONS IN TWO PRONG TOPOLOGY IN pi^+p INTERACTIONS NEAR 1 GeV/C. Ahmad, Z. Buffalo; State Univ. of New York (1975). 152p. University Microfilms Order No. 75-18,766.

Thesis (Ph. D.).

The reaction pi^+p yields pi^+ppi^0 was analyzed at 1.04, 1.22 and 1.39 GeV/c using recently developed techniques such as longitudinal phase space (LPS) analysis along with established methods which utilize Dalitz plots, and Chew-Low plots. The reaction was found to proceed primarily via the formation of the resonance N^{*++}. Models developed by Chan, Loskiewicz and Allison (CLA model), Plahte and Roberts, and Roberts were investigated to determine their applicability in this energy region. The analysis of the pi^+ inclusive spectra in the target and the projectile frames show that they are similar in shape in the target and projectile fragmentation regions. The cross section does not scale at these energies. However, the value of the cross section integrated over a given interval of longitudinal momentum in the target fragmentation region decreases with beam energy which provides a qualitative support to Mueller's hypothesis of inclusive reaction. The shape of the pi^+ inclusive spectra in the target fragmentation region was found to be primarily due to the resonance N^{*++}. The pi^0 inclusive spectra at the three beam energies, when viewed either in the target or projectile fragmentation region, show similar behavior over a very small interval of longitudinal momentum and have little in common with pi^+ inclusive spectra. An investigation of the transverse-momentum-squared distributions show that the sharp peaks in the pions transverse-momentum-squared distributions are due to the resonances produced in the reaction. (Diss. Abstr. Int., B)

15849 MASS RELATIONS FOR CHARMED BARYONS. Franklin, J. (Temple University, Philadelphia, Pennsylvania 19122). Phys. Rev. D 12: No. 7, 2077-2081 (1 Oct 1975).

A minimal-symmetry quark model for baryons is extended by charmed-quark substitution to charmed baryons. This induces a transformation of 9 mass relations for the 18 uncharmed baryons directly into 14 mass relations for 22 charmed baryons, with minimal SU(4) or SU(8) symmetry assumptions. Of the charmed-baryon mass relations, 6 are for mass differences of electromagnetic order and 8 are for strong mass differences. (auth)

15850 PARTICLE COMPOSITION AND QUARK CASCADE IN ENERGETIC HADRON COLLISIONS. Matsuda, S. (Departmen Physics, Kyoto University, Sakyo-ku, Kyoto 606, Japan). Phys. Rev. D 12: No. 7, 1940-1946 (1 Oct 1975).

The particle composition data at high p_T in nucleon-nucleon scattering are explained in terms of the quark content and the quark cascade within the nucleon. The analysis lends strong support to the quark model of hadrons. Characteristic predictions are also made for particle ratios at high p_T in meson-nucleon scattering processes. (auth)

15851 STRONG PRODUCTION MECHANISMS AND TOTAL CROSS SECTIONS OF ψ PARTICLES. Gaisser, T.K. (Bartol Research Foundation of The Franklin Institute, Swarthmore, Pennsylvania 19081); Halzen, F.; Kajantie, K. Phys. Rev. D 12: No. 7, 1968-1974 (1 Oct 1975).

New BNL and Fermilab data on the production of ψ particles in hadron collisions are shown to imply that the intrinsic production cross section of a particle of mass m varies as $1/m^2$ and scales in the variable $s^{1/2} - s^{\text{threshold } 1/2}/m$. Vector-meson-proton total cross sections are also observed to be proportional to $1/m^2$, and a connection between production mechanisms and total cross sections is pointed out. On the basis of the existence of high-mass diffraction dissociation in hadron collisions, explicit estimates for diffractive production of ψ are also given. Our calculations are also directly applicable to the hypothetical charmed particles. (auth)

15852 UNITARITY EFFECTS IN PION-PRODUCTION ISOBAR AMPLITUDES. Aaron, R.; Thompson, R.H. (Department of Physics, Northeastern University, Boston, Massachusetts 02115); Amado, R.D.; Arndt, R.A.; Teplitz, D.C.; Teplitz, V.L. Phys. Rev. D 12: No. 7, 1984-1991 (1 Oct 1975).

In isobar analyses, the amplitude for particle + particle → particle + isobar usually is taken to be independent of the mass of the isobar, but Aaron and Amado have shown this approximation to be inconsistent with unitarity. Here we continue that work by calculating numerically the absorptive part of isobar amplitudes in the case of $\pi N \to \pi\pi N$ using the recent world analysis of 200 000 resonance region events. (auth)

Strong (Baryon No. ≥ 2)

Refer also to abstract 15842.

15853 (INIS-mf-1847) NUCLEON–NUCLEON INTERACTION. II. Brown, G. E.; Jackson, A. D. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). 1974. 152-387p. INIS.

Notes based on lectures given at the Niels Bohr Institute and NORDITA during 1973 and 1974.

Modifications of the Lippmann-Schwinger equation necessitated by the kinematic requirements of relativity are considered. Electromagnetic nucleon form factors are calculated, and one-boson-exchange contributions to the nucleon–nucleon interaction are found. The two-pion exchange interaction is also considered. The potential is constructed, and the explicit forms of the Reid soft-core potential and the Hamada-Johnston hard-core potential are listed.

15854 (LUIP-CR-75-01) CORRELATIONS BETWEEN THE NUMBER OF HEAVY PRONGS AND THE NUMBER OF SHOWER

PARTICLES IN PROTON–NUCLEUS COLLISIONS. Andersson, B.; Otterlund, I. (Lund Univ. (Sweden)). 1975. 36p. Dep. NTIS (US Sales Only) $4.00.

The correlation between the properties of the heavy prong and the shower particle distributions from high energy proton–nucleus interactions are considered in phenomenological models in which the number of collisions between the impinging proton and the nucleons inside the nucleus is the major parameter. (auth)

15855 RELATIVISTIC EQUATION OF THE NUCLEON AND THE DOUBLET XI. Casanova, G. C. R. Hebd. Seances Acad. Sci., Ser. A, B; 280: No. 19, 1321-1324(21 May 1975). (In French)

Generalizing the Dirac equation, one introduces the pionic field and associates the isospin with rotations of the proper space by relativistic invariance. The strangeness S of the doublet XI is determined, and divergences of isovectors allow the calculation of the charge with the help of pionic components on isovectors. The signs of magnetic moments, the nonexistence of a strange and baryonic doublet with charges $(0,e^{+})$ are explained and sign of differences between the doublet's element are connected. (FR)

15856 QUADRUPOLE MOMENT OF THE DEUTERON: EFFECT OF BARYON RESONANCES. Williams, H. T.; Dempsher, D. P. (Washington and Lee Univ., Lexington). Lett. Nuovo Cim.; 13: No. 17, 636-638(23 Aug 1975).

A determination is made of the deuteron electric quadrupole moment, and the effects of nuclear baryon resonance admixture are discussed. (JFP)

15857 THEORETICAL STUDY OF A Λp RESONANCE WITH TWO-CHANNEL FORMALISM. Satoh, E. (International Centre for Theoretical Physics, Trieste, Italy); Iwamura, Y.; Takahashi, Y. Phys. Rev. Lett. 35: No. 17, 1128-1131 (27 Oct 1975).

We investigate the Λp invariant-mass distribution, observed by Cline, Laumann, and Mapp, with a two-channel formalism. We come to the conclusions (1) that the peak just below the ΣN threshold is mainly due to a Λp resonance (it would not be explained by a kinematical effect alone), and (2) that the peak just above the ΛN threshold is due to the two-channel final-state interaction. (auth)

15858 PRODUCTION OF J (ψ) IN pp SCATTERING. Barnett, R.M. (Lyman Laboratory of Physics, Harvard University, Cambridge, Massachusetts 02138); Silverman, D. Phys. Rev. D 12: No. 7, 2037-2042 (1 Oct 1975).

The hypothesis of a heavy-quark–antiquark meson (orthocharmonium) for the 3.1-GeV resonance leads, in the context of a general peripheral model, to predictions for the cross sections (and their energy dependence) for J (ψ) production. The $p_{\perp}$ dependence is predicted to be quite different from that of the pion. At higher energies, charmed particles are expected to be produced in conjunction with each J (ψ). Related problems are discussed. (auth)

15859 HADRONIC PRODUCTION OF THE NEW RESONANCES: PROBING GLUON DISTRIBUTIONS. Einhorn, M.B.; Ellis, S.D. (Fermi National Accelerator Laboratory, Batavia, Illinois 60510). Phys. Rev. D 12: No. 7, 2007-2014 (1 Oct 1975).

Assuming that the new resonances observed at 3095 and 3684 MeV are bound states of a new, heavy quark and its antiquark, we consider several models for the production of such states in hadronic collisions. The dominant mechanism by which these particles couple to other hadrons (composed of normal quarks) may be via gluons. In analogy with the Drell-Yan model for quark-antiquark annihilation into a massive virtual photon, those new particles with even charge conjugation may be regarded as produced by gluon-gluon annihilation. Thus the (presently) hypothetical 0^{-+} partner (η_c) of the observed particles may serve as a short-distance probe of the gluon distributions within hadrons. We estimate the production cross section of η_c in nucleon-nucleon collisions using various models for gluon distributions. In addition, estimates are made for the production of finite states containing pairs of charmed hadrons in the central region. (auth)

15860 np CHARGE-EXCHANGE AND THE σ MODEL. Diu, B. (Laboratoire de Physique Théorique des Hautes Energies, Université Paris VII, Paris, France). Phys. Rev. D 12: No. 7, 1992-1998 (1 Oct 1975).

The shape of the np charge-exchange forward spike implies striking properties for the amplitudes. These are shown to indicate the existence of a pole-like singularity located near the physical threshold $(u = 4m^2)$ for the u channel $\bar{p}p \to \bar{n}n$. If this singularity is due to the exchange of a single particle, it must be an isospin zero, G parity +, scalar meson, and its coupling to the nucleons has to be equal to that of the π; one is thus led naturally to the σ model as giving a simple interpretation of the very special properties of the amplitudes. (auth)

15861 QUADRATIC RELATIONS AMONG OBSERVABLES IN p-p SCATTERING. Delaney, R.M.; Gammel, J.L. (Saint Louis University, St. Louis, Missouri 63103). Phys. Rev. D 12: No. 7, 1978-1983 (1 Oct 1975).

The 25 observables which describe p-p scattering are related by 16 independent quadratic relations. A method is developed for determining these quadratic relations. Provided a certain condition is satisfied, the particular set so determined and the results of 15 planned experiments at Argonne National Laboratory yield a unique solution for the 25 observables and, up to a common phase factor, for the five amplitudes. (auth)

15862 GEOMETRICAL SCALING IN THE PROCESS $pp \to pX$. Kasman, J.; Moen, I.O. (Physics Department, McGill University, Montreal, Canada). Phys. Rev. D 12: No. 7, 2169-2171 (1 Oct 1975).

We consider the extension of geometrical scaling from pp elastic scattering to $pp \to pX$ in the limit $s \to \infty$, s/M^2 fixed. We show that for nondecreasing total cross sections, the radius for the inelastic diffraction cannot be related simply to the elastic radius. A form of geometrical scaling suitable for data analysis is suggested. (auth)

15863 GEOMETRIC SCALING AND MULTIPLICITY DISTRIBUTION IN HIGH-ENERGY pp COLLISIONS. Torgerson, R.; Kamal, A.N. (Theoretical Physics Institute, Department of Physics, University of Alberta, Edmonton, Alberta, Canada). Phys. Rev. D 12: No. 7, 1947-1951 (1 Oct 1975).

We find an empirical representation, employing geometric scaling, for the profile function at CERN ISR energies ($23.5\ \text{GeV} \leq \sqrt{s} \leq 53\ \text{GeV}$). A Fermi distribution dominates the profile function shape but a small negative Gaussian term is required to fit $d\sigma/dt$ in the region of the secondary maximum. We find a sharp peak in the opacity at $b = 0$. These results are used to discuss a variety of geometric proposals for understanding the multiplicity distribution. (auth)

15864 DECK MODEL APPLIED TO BARYONIC SYSTEMS. Cutler, R.T.; Wyld, H.W. Jr. (Department of Physics, University of Illinois, Urbana, Illinois 61801). Phys. Rev. D 12: No. 7, 1952-1967 (1 Oct 1975).

Reggeized Deck model calculations are performed for the reactions $p\bar{p} \to p\bar{p}\pi^{+}\pi^{-}$, $pp \to pp\pi^{+}\pi^{-}$, and $pp \to pX$. The calculations are compared with a new CERN-Serpukhov experiment at 25 and 40 GeV for the first reaction and with recent high-energy data from Fermilab and the CERN ISR for the other two reactions. (auth)

Particle Invariance Principles and Symmetries

General

15865 CHARGES AS INTEGRALS OVER DENSITIES. An Alternative Formulation of Coleman's Theorem. Gal-Ezer, E. (Tel Aviv Univ. (Israel). Dept. of Physics and Astronomy); Reeh, H. (Goettingen Univ. (F. R. Germany). Inst. fuer Theoretische Physik). Commun. Math. Phys.; 43: No. 2, 137-141 (Jul 1975).

7 refs.

The charge operator is hermitean if and only if the vacuum is invariant. In that case the charge must be invariant under time translations. (DE)

Applications (Electromagnetic and Weak)

Refer also to abstracts 15797, 15801, and 15820.

15866 CHARMED-BARYON PAIR PRODUCTIONS IN $e^{+}e^{-}$ ANNIHILATIONS. Muta, T. (Kyoto Univ). Lett. Nuovo Cim.; 13: No. 18, 661-665(23 Aug 1975).

Restriction is made to the familiar SU(4) quartet scheme to determine whether the experimental data on $e^{+}e^{-} \to$ hadrons total cross sections, having an interesting structure around the Ψ (4.15) resonance, can be explained by opening new channels of charmed-hadron productions. These new contributions to the $e^{+}e^{-}$ total cross sections are estimated assuming the Ψ vector dominance for the charmed hadron form factors. (JFP)

15867 SIX-QUARK MODEL FOR THE SUPPRESSION OF $\Delta S = 1$ NEUTRAL CURRENTS. Gürsey, F.; Ramond, P.; Sikivie, P. (Department of Physics, Yale University, New Haven, Connecticut 06520). Phys. Rev. D 12: No. 7, 2166-2168 (1 Oct 1975).

We propose an alternative arising naturally in a six-quark model to the Glashow-Iliopoulos-Maiani mechanism for the suppression of $\Delta S = 1$ neutral currents. While violating the Cabibbo form of universality, it maintains the $\tan^2\theta_C$ suppression of strange particle decays and introduces an additional $\tan\theta_C$ suppression of charmed-particle decays. (auth)

15868 DEEP-INELASTIC DATA AS A TEST OF HADRON SYMMETRIES. Palmer, W.F.; Wada, W.W. (Department of Physics, The Ohio State University, Columbus, Ohio 43210). Phys. Rev. D 12: No. 7, 1975-1977 (1 Oct 1975).

It is proposed that the deep-inelastic electron- and neutrino-scattering data near $x = 0$ provide a way of distinguishing between SU(3) and SU(4) as the fundamental underlying hadron symmetry. (auth)

Applications (Strong)

Refer also to abstracts 15837, 15849, and 16198.

15869 (DESY-75/38) DECAY OF THE $\psi(3.1)$ IN BROKEN SU(4). Kazi, A.; Kramer, G.; Schiller, D. H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Oct 1975. 12p. Dep. NTIS (US Sales Only) $3.50.

The mass spectra are calculated for vector and pseudoscalar mesons in broken SU(4) and study the dependence of the wave functions on the parameters which determine the mixing between singlet and fifteenplet. With these wave functions various two-body decays of $\psi(3.1)$ are computed. (auth)

15870 (IC-74-98) STUDY OF THE HIGH-ENERGY REACTION ANTI PP → ANTI PP. Samiullah, M.; Anwarian, S. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1974. 17p. INIS.

2 figs., 4 tables.

The high energy behavior of the reaction $\bar{p}p \to \bar{p}p$ at $P_L = 8$ (GeV/c) and $P_L = 16$(GeV/c) is studied in the context of $\hat{O}(3,1)$ symmetry. In view of the many exchanged particles, approximate equivalence relations in s-channel amplitudes are used which cut down the unknown parameters to a manageable set of adjustable constants. The analysis has essentially explained the characteristic features of this reaction which are: the ending of the forward peak at $|t| \simeq 0.6$ (GeV/c)^2; developing of a shoulder at larger $|t|$'S; and decreasing of the differential cross section at the shoulder for 16 (GeV/c) at a slower rate than 8 (GeV/c). (auth)

15871 (IPNO-TH-75-10) DISPERSION THEORY OF PARITY NONCONSERVATION IN PION-NUCLEON SCATTERING AT LOW ENERGIES. Chemtob, M.; Hadjimichael, E. (Paris-11 Univ., 91 – Orsay (France). Inst. de Physique Nucleaire). Apr 1975. 37p. INIS.

The possibility for testing the weak parity non-conserving (pnc) interaction in pion-nucleon scattering at low energies is examined. The analysis starts by assuming the existence of a pnc πNN coupling which conserves time reversal invariance and has the isospin selection rule $\Delta I = 1$, and the existence of fixed-t dispersion relations obeyed by the pnc invariant amplitudes. By using the non-relativistic expansion, dispersion relations for the partial wave amplitudes are derived. Parity-odd observables in $\pi^-p \to \pi^-p$ and in $\pi^-p \to \pi^0n$, e.g., the up-down asymmetry α in the total cross section for a polarized target and the longitudinal polarization P of the recoil nucleon are calculated. In the conventional Cabibbo model for the weak interaction, P and α are found to be of order 10^{-7} to 10^{-6}. The t-channel pnc ρ-exchange process which has the isospin selection rule $\Delta I = 0,2$ is also examined and found to contribute dominantly to P in the charge exchange channel $\pi^-p \to \pi^0n$. (FR)

15872 SU(6) SYMMETRY BREAKING EFFECTS IN DEEP INELASTIC SCATTERING. Carlitz, R. (Chicago Univ., Ill. (USA). Enrico Fermi Inst.). Phys. Lett., B; 58: No. 3, 345-347(15 Sep 1975).

The fact that the N and Δ states of the 56 baryons are not degenerate in mass is shown to imply that the deep inelastic scattering ratio $F_{2n}x/F_{2p}x$ should approach $\frac{1}{4}$ as $x \to 1$. The rate of approach is predicted to be approximately linear in x. The possibility of observing analogous effects in other large momentum transfer processes is also discussed. (NL)

15873 QUARK CONFINEMENT AND THE EVASION OF GOLDSTONE'S THEOREM IN 1 + 1 DIMENSIONS. Kogut, J. (Laboratory of Nuclear Studies, Cornell University, Ithaca, New York 14853); Sinclair, D.K. Phys. Rev. D 12: No. 6, 1742-1753 (15 Sept 1975).

Gauge theories of quarks which possess approximate chiral SU(3) ×SU(3) symmetry also have approximate U(3) ×U(3) symmetry. If the axial symmetries are realized in the Goldstone mode, then one would naively expect a fourth SU(3) singlet pseudoscalar meson with mass comparable to that of the pion. This is contrary to experiment. It has been argued, however, that quark confinement can remove the unwanted Goldstone boson from the physical spectrum of the theory. It is the purpose of this article to shed light on this phenomenon by studying it in a simple setting. We consider the σ model with minimal electrodynamic coupling in 1+1 dimensions. We confirm that the singlet Goldstone boson is indeed absent although the axial symmetry is spontaneously broken. The would-be massless meson gains a mass from the long-range interactions responsible for confinement. If the Abelian gauge coupling is set to zero, the axial symmetry is no longer spontaneously broken. Using equivalent-boson methods a simple proof of the equivalence of the nonlinear σ model and the Thirring model (with an additional decoupled massless field) is presented. (auth)

15874 QUARK BINDING IN THE COLOR SU(2) GAUGE MODEL. Ma, E. (Department of Physics, University of California, Santa Barbara, California 93106). Phys. Rev. D 12: No. 7, 2101-2104 (1 Oct 1975).

The question of quark binding is examined in the context of a recently proposed gauge model of superstrong interactions which is both asymptotically free and devoid of infrared divergences. In this model, the color SU(2) symmetry is broken by the presence of a scalar gluon which is also responsible in part for the dynamics. We find in the static approximation that $E_{min}(q\bar{q}) \leq E_{min}(qq)$, but that $E_{min}(qqq) < E_{min}(qq\bar{q})$ only if three-body forces are operative. Further dynamical implications are also discussed. (auth)

15875 THREE-BODY FORCES IN THE STATIC SOURCE APPROXIMATION. Ma, E. (Department of Physics, University of California, Santa Barbara, California 93106). Phys. Rev. D 12: No. 7, 2105-2107 (1 Oct 1975).

As evidenced by a recent analysis of the color SU(2) gauge model, three-quark forces may be important in the formation of baryons. These forces are derived from the self-interaction of the field quanta (gluons) that are being emitted or absorbed by the static sources (quarks). The resulting three-body potential is shown to be nonvanishing only if all three bodies are close together, and it is shown to be attractive if both quark and gluon masses are generated via the Higgs mechanism. (auth)

Scattering Theory

Refer also to abstracts 16201 and 16202.

15876 (CRN-C-10) NONRELATIVISTIC THEORY OF COLLISIONS: LECTURE NOTES. Leite Lopes, J.; Spehler, D. (Centre National de la Recherche Scientifique, 67 – Strasbourg (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France)). 1975. 252p. (In French). INIS.

These are lecture notes on the nonrelativistic scattering theory with an emphasis on the analytical properties of scattering amplitudes, Jost fonctions, study of Regge poles and Regge trajectories for potentials which are a superposition of Yukawa potentials. (FR)

15877 (ITP-75-87E) THRESHOLD BEHAVIOR OF SIMPLE AND DOUBLE REGGE POLE TRAJECTORIES. Burgii, A. I. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1975. 27p. Dep. NTIS (US Sales Only) $4.00.

The threshold behavior of simple and double Regge pole trajectories is studied. It is shown that for a number of cases two particle unitarity gives rise to moving J-plane zeroes, colliding at threshold with Regge poles. Conditions are found for which Regge trajectories have near the threshold $S = S_0$ square root behavior independent of the value of $\alpha(S_0)$. A dual model for the scattering amplitude is considered in which the threshold behavior of trajectories agrees with particle unitarity. (auth)

15878 PERIODIC ORBITS OF COLLISION IN THE RESTRICTED PROBLEM OF THREE BODIES, WHEN THE BIGGER PRIMARY IS A SLOWLY ROTATING OBLATE SPHEROID. Sharma, R. K. (Univ., Delhi). Indian J. Pure Appl. Math.; 5: No. 2, 192-200(Feb 1974).

The restricted problem of three bodies is regularized in the neighborhood of bigger finite mass, which was taken as an oblate spheroid rotating with a small angular velocity about its axis of symmetry. Perturbation equations for the problem under consideration are derived in the form of Hamilton's equations of motion. The existence of periodic symmetric as well as doubly symmetric orbits was studied. Lastly, it is shown that periodic orbits satisfy the Levi-Civita's (1904) condition for collision. (auth)

15879 SCATTERING OF SCALAR PARTICLES ON THE YANG AND MILLS POTENTIAL. Kerner, R. (Paris-6 Univ., 75 (France)). C. R. Hebd. Seances Acad. Sci., Ser. A, B; 280: No. 21, 1463-1466(2 Jun 1975). (In French)

The invariant equations describing the interaction between a scalar multiplet and a non-Abelian gauge field are derived. These equations are applied to the description of the scattering process. After performing an approximate calculation, valid for the high energy and sufficiently weak binding constant, the Jost functions corresponding to this particular physical situation are explicitly obtained. (FR)

15880 ON THE INVERSE PROBLEM FOR THE RADIAL SCHROEDINGER EQUATION WITH AN ENERGY-DEPENDENT POTENTIAL. Jaulent, M. (Montpellier-2 Univ., 34 (France). Dept. de Physique Mathematique). C. R. Hebd. Seances Acad. Sci., Ser. A, B; 280: No. 21, 1467-1470(2 Jun 1975). (In French)

Some improvements are presented to a previous study on the inverse problem for the radial-wave Schroedinger equation. (FR)

15881 SCATTERING PROBLEMS OF QUANTUM MECHANICS. Delves, L. M. (Univ., Liverpool). pp 321-333 of Numerical Solution of Integral Equations. Delves, L. M. (ed.). Oxford; Clarendon Press (1974).

After a short paragraph introducing the basic energy equation T + V = E, the subject is covered in sections entitled collision between two particles; solution for negative E; solution for positive E; three-body scattering; numerical solution of the Faddeev equations. (UK)

15882 UNITARITY AND ASYMPTOTIC CONDITION IN A MODEL WITH DIPOLE GHOST. Sekine, K. (Meisei Univ., Hino, Tokyo (Japan). Dept. of Physics). pp 196-198 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975).

The mechanism of obtaining a unitary "physical" S-matrix in a simple model involving dipole ghost scattering will be clarified. (DE)

15883 SCATTERING THEORY OF THE LINEAR BOLTZMANN OPERATOR. Hejtmanek, J. (Vienna Univ. (Austria). Mathematisches Inst.). Commun. Math. Phys.; 43: No. 2, 109-120(Jul 1975).

12 refs.

In time dependent scattering theory we know three important examples: the wave equation around an obstacle, the Schroedinger and the Dirac equation with a scattering potential. In this paper another example from time dependent linear transport theory is added and considered in full detail. First the linear Boltzmann operator in certain Banach spaces is rigorously defined, and then the existence of the Moeller operators is proved by use of the theorem of Cook-Jauch-Kuroda, that is generalized to the case of a Banach space. (DE)

15884 MICROLOCAL STUDY OF S-MATRIX SINGULARITY STRUCTURE. Kawai, T. (California Univ., Berkeley (USA). Dept. of Mathematics; Kyoto Univ. (Japan). Research Inst. for Mathematical Sciences); Stapp, H. P. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). pp 38-48 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 3 figs.; 10 refs.

Support is adduced for two related conjectures of simplicity of the analytic structure of the S-matrix and related function; namely, Sato's conjecture that the S-matrix is a solution of a maximally over-determined system of pseudo-differential equations, and our conjecture that the singularity spectrum of any bubble diagram function has the conormal structure with respect to a canonical decomposition of the solutions of the relevant Landau equations. This latter conjecture eliminates the open sets of allowed singularities that existing procedures permit. (DE)

15885 INELASTIC EIKONAL PHENOMENOLOGY IN A STATIONARY-PHASE APPROXIMATION. Moreno, H. (Departamento de Fisica, Centro de Investigacion y de Estudios Avanzados del Instituto Politecnico Nacional, Apartado Postal 14-740, Mexico 14, D. F.); Fried, H.M. Phys. Rev. D 12: No. 7, 2031-2036 (1 Oct 1975).

A stationary-phase approximation to a functional-integral representation of model elastic and inelastic pion amplitudes is shown to yield a phenomenology corresponding to the simplest possible unitary model. Possible relevance at CERN ISR energies may be easily tested. (auth)

15886 IS ABSORPTION A CONSEQUENCE OF UNITARITY? Sachrajda, C.T.; Blankenbecler, R. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). Phys. Rev. D 12: No. 6, 1754-1764 (15 Sept 1975).

Absorptive corrections to scattering and production in a family of explicitly unitary models are studied. We find that in a particular model in which quantum-number constraints are ignored, all the results concerning absorptive corrections found in the Reggeon-calculus model of Abramovskii, Kancheli, and Gribov are reproduced. In extended models, however, the effects due to quantum numbers and/or alternative unitarization schemes are shown to have a significant effect on the form of absorptive corrections. In particular, explicitly unitary models are given in which (i) the absorptive corrections enhance all cross sections, and (ii) isospin is introduced in a simple way and is found to produce quite different counting rules from those assumed in the Reggeon calculus. It is shown that the internal quantum-number structure of the Pomeron affects the amount of absorption in inclusive cross sections and hence can be experimentally studied. (auth)

15887 ENERGY-DEPENDENT COMPLEX SCALE DIMENSIONS IN POTENTIAL SCATTERING. Pradhan, T.; Khare, A. (Institute of Physics, A/105 Saheed Nagar, Bhubaneswar-751007, India). Phys. Rev. D 12: No. 6, 1794-1797 (15 Sept 1975).

We show that there exist potentials for which bound states exhibit scale invariance at short distances with anomalous dimensions. Close scrutiny of the partial-wave S matrix for these potentials reveals that it has poles in the "complex scale-dimension plane" which move with energy. (auth)

PHYSICS (LOW-TEMPERATURE)

Superconductivity

Refer also to abstracts 14983, 15200, 15208–15210, 15233, 15244, 15247, 15253, 15259, 15262–15264, 15278, 15300, 15314, 15316, and 16209.

15888 (AD/A-006593) MANY-BODY PROBLEMS. Final Report, 1 April 1964–30 September 1974. Bloch, F. (Stanford Univ., Calif. (USA). Dept. of Physics). Dec 1974. Contract N00014-67-A-0112-0047. 11p. NTIS $3.25.

The research, carried out under the contract, was mostly directed towards the investigation of low-temperature phenomena, in particular superconductivity and superfluidity and the related problems of interacting Fermi and Bose systems. Several other investigations were carried out, however, during the first half of the contract period. Research in the following areas are discussed: nonlinear optics; nuclear magnetic moments; correlation effects in conjugated molecules; superconductivity and interacting Fermi systems; superfluidity and interacting Bose systems. (GRA)

15889 (BNL-tr-616) THEORY OF MULTIFILAMENTARY SUPERCONDUCTING TAPES. Hlasnik, I. Translated by S. J. Amoretty from Elektrotech. Cas.; 26: No. 4, 259-270(1975). 21p. Dep. NTIS $4.50.

Eddy currents in a conventional metal are calculated for a multifilament superconducting tape in a variable magnetic field with anti B perpendicular to the plane of the tape. On this basis, additional losses due to these currents are calculated and compared with the losses in the superconductor. The conditions under which the results are valid were determined and compared with analogous results obtained by using a simplified Smith model for multifilament superconducting wires. 5 figures (auth)

15890 (BNL-tr-619) THEORY OF SUPERCONDUCTING TAPES. Hlasnik, I. 1975. Translated by S. J. Amoretty from Czech Report. (CONF-750950-2). 23p. Dep. NTIS $4.50.

From conference on technical applications of superconductivity; Alushta, USSR (16 Sep 1975).

Attention has been focused recently on superconducting tape conductors because of the possibility of using them in flexible superconducting ac and dc cables and because of the development of the technology of fabricating multifilament tape superconductors for superconducting magnets. A presentation is given of some of the results obtained in studying the effect of the geometry of such conductors on the current distribution and losses occurring in them and on the magnitude and anisotropy of their critical current. Using functions of a complex variable, the current distribution is examined in a straight section of a tape under conditions of partial penetration of the transport current. It is shown that additional ac current losses occur in the tape due to a nonuniform distribution of the current. The distribution of the magnetic field and current in a round single-layer cable with tightly wound superconducting tapes in the presence of a transport current is then analyzed. Use is made of the equations for the critical current and for the additional current losses occurring in this cable when ac current is applied, as a function of the angle of inclination of the helically wound tapes. Finally, the effect of inclination of the oblate helically wound tapes of the multifilament superconductor on the critical current and its dependence on the direction of the magnetic induction vector anti B relative to the conductor's plane are examined. 8 figures (auth)

15891 (ERDA-tr-86, pp 25-31) DIRECT OBSERVATION OF MAGNETIC FLUX STRUCTURES IN SUPERCONDUCTORS. Obst, B. (Institute for Experimental Nuclear Physics, Karlsruhe, Ger.). Jan 1975. Translated from German Report.

In reports of the Nuclear Research Center, Karlsruhe. 7th annual publication.

In the case of alternating or rapidly changing currents and fields, superconductors dissipate energy. The almost loss-free transport of relatively high direct currents within certain limits is based on the anchoring of magnetic structures by their interaction with the microstructure of the material. The study of such type "pinning" mechanisms belongs — in addition to questions of loss behavior — to the subject areas which are being studied in our group (basic research on superconductivity) on a priority basis. It is shown here, after a short representation of the phase transition with superconductors of the first and second type, an investigative method which especially clearly demonstrates the effect of metallurgical values on superconducting properties, the decoration technique for visualization of magnetic structures. There follows a short explanation of the anchoring mechanisms with examples of flux distribution whose adjustment to the thermodynamic equilibrium in the outer field is inhibited. (auth)

15892 (IS-M-51) SINGLE CRYSTAL ELASTIC CONSTANTS WITH INFERENCES PERTINENT TO VIBRATIONAL BEHAVIOR AND SUPERCONDUCTIVITY. Smith, J. F. (Ames Lab., Iowa (USA); Iowa State Univ. of Science and Technology, Ames (USA)). 1975. 12p. (CONF-751212-1). Dep. NTIS $4.50.

From international conference on low lying lattice vibrational models and their relationship to superconductivity and ferroelectricity; San Juan, Puerto Rico (1 Dec 1975).

Data are presented to show that indications of mode softening may be obtained from elasticity measurements. In the extreme limit where mode softening results in the vanishing of an elastic constant, phase instability ensues. Mode softening and superconductivity are interrelated, and unusual elastic behavior is often observed in superconductors. Such elastic behavior and superconductivity seem to arise from a common cause. 1 table. (auth)

15893 THE INFLUENCE OF SPIN FLUCTUATIONS ON THE TRANSITION TEMPERATURE OF A TWO BAND SUPERCONDUCTOR. Entel, P.; Fischer, O.; Bongi, G. (Geneva Univ. (Switzerland). Dept. de Physique de la Matiere Condensee); Klose, W. (Kernforschungszentrum Karlsruhe (F. R. Germany)). Z. Phys., B; 21: No. 4, 363-368(Aug 1975). (In German) 4 figs.; 16 refs.

The superconducting transition temperature T_c of a two band superconductor in the presence of magnetic and nonmagnetic impurities as well as exchange fields is calculated using a new (8×8)-matrix formalism for the electron Green's function. In particular, the influence of spin correlations on T_c is investigated near magnetic phase transition. It is shown that in the strong interband phonon coupling limit the system behaves essentially as a one band superconductor. In the weak coupling limit typical deviations from one band theories is found. (DE)

15894 SUPERCONDUCTING A-15 COMPOUNDS. A Review. Dew-Hughes, D. (Lancaster Univ., Eng.). Cryogenics; 15: No. 8, 435-454(Aug 1975).

The critical superconducting parameters of A-15 compounds are reviewed and the trends analyzed in order to predict maximum values. Experimental data on critical temperature is summarized and compared with theory. The ability to form the stoichiometric, well-ordered materials required for maximum T_c is discussed in terms of the thermodynamic stability of the A-15 phase. It is concluded that critical temperatures in excess of 25 K, in the A-15 structure, are unlikely. The upper critical field data show that, whereas the vanadium-based compounds are paramagnetically limited, the niobium-based compounds are not. The relation between critical current and microstructure is explored. Best data on critical current densities and ac losses is presented. Finally an account is given of the various methods by which actual conductors, both tapes and multifilamentary wires, are made. (auth)

15895 DENSITIES OF STATES IN ISOLATED FLUX VORTICES IN SUPERCONDUCTORS. Donaldson, G. B.; Brassington, D. J.; Band, W. T. (Lancaster Univ., Eng.). J. Phys., F (London); 5: No. 9, 1726-1744(Sep 1975).

The densities of states of quasiparticles in isolated flux vortices in clean limit superconductors have been calculated for various κ, using an extension of calculations by Bardeen et al. Results similar to the dirty limit calculations of Watts-Tobin et al. were found, with the density per unit length at zero energy varying from $4\pi\xi^2 n(O)$ at low κ to $7\eta\xi^2 n(O)$ at $\kappa = 30$, where ξ is the coherence length and $n(O)$ the one-electron density of states per unit volume at the Fermi surface. Experimental studies of the density $N(E)$ as a function of energy were performed by tunnelling on thin films of Pb, Sn, and Al at less than 0.1 K. Good agreement was found between the experimental and theoretical reduced densities $N(E)/N(O)$. The absolute magnitude of $N(O)$ was, however, too small by a factor of about 5. This may be evidence for the contribution of the tunnelling anisotropy factor first discussed by Band and Donaldson. (auth)

15896 FLUCTUATION ENHANCED CONDUCTIVITY IN AMORPHOUS SUPERCONDUCTORS. Keck, B.; Schmid, A. (Dartmund Univ., Ger.). Solid State Commun.; 17: No. 7, 799-801(1 Oct 1975).

Considering the effective phonon density of states obtained by tunnel spectroscopic measurements, it is concluded that in amorphous metals such as Bi, Ga, and Pb, the electron-phonon

collision rate becomes as large as 10^{12}/sec at the transition temperature. This is attributed to the collision drag effect which couples low frequency transverse phonons to the electrons. It is shown that such a large collision rate suppresses the Maki contribution to the fluctuation enhanced conductivity. (auth)

15897 ONE-DIMENSIONAL CONDUCTORS. GPS Summer School Proceedings. Schuster, H. G. (ed.). (Universitaet des Saarlandes, Saarbruecken (F. R. Germany). Fachbereich Physik). Lecture Notes in Physics. Berlin, F. R. Germany; Springer (1975). 371p.

From summer school of the Fachausschuss Tiefe Temperaturen of the Deutsche Physikalische Gesellschaft; Saarbruecken, F. R. Germany (10 Jul 1974).

With figs., tabs., and refs.

The volume contains the 24 papers read during the conference held at Saarbruecken from the 10th – 12th of July, 1974. (DE)

15898 CHEMICAL POTENTIAL AND BOUNDARY RESISTANCE AT NORMAL-SUPERCONDUCTING INTERFACES. Waldram, J. R. (Cambridge Univ., Eng.). Proc. R. Soc. (London), Ser. A; 345: No. 1641, 231-249(30 Aug 1975).

The ideas of Pippard, Shepherd & Tindall and of Rieger, Scalpino & Mercereau about what happens when normal current is converted to supercurrent at an interface are re-examined. It is found that near such an interface the pair energy of the superfluid is no longer equal to the Fermi energy, and careful consideration of the chemical potentials involved shows that measurable electric fields may exist inside the superconductor. The size of this effect is determined by the degree of imbalance between electron-like and hole-like excitations, which in turn depends on the rates of processes which restore this balance (branch-crossing processes). The paper contains first a reconsideration of the meaning of chemical potential and the supercurrent equations in such nonequilibrium situations, then a detailed reassessment of the calculation of the boundary resistance by Pippard et al. (which is substantially modified), and finally some criticisms of the approach used by Rieger et al. which is based on time-dependent Ginzburg-Landau theory. (auth)

15899 FLUX JUMP AND CRITICAL STATE STABILITY IN SUPERCONDUCTORS. Mints, R. G.; Rakhamov, A. L. (Inst. of High Temperatures, Moscow). J. Phys., D (London); 8: No. 15, 1769-1782(21 Oct 1975).

The critical state stability in a "hard" type-II superconductor with respect to the flux jumps has been studied both for adiabatic and isothermal boundary conditions. The sample geometry as well as initial magnetic field and current distributions are found to be important for the stability criterion. The increase of the ratio of the thermal and magnetic diffusivities results in an increase of the stability. This effect is most noticeable in the case of intensive external cooling. For the extremely "hard" superconductors the simplified scheme of the investigation is proposed. (auth)

PHYSICS (NUCLEAR)

15900 (COO-1167-36) NUCLEAR CHEMISTRY RESEARCH. Progress Report, November 1, 1974-October 31, 1975. Sugarman, N.; Turkevich, A. (Chicago Univ., Ill. (USA)). 31 Oct 1975. Contract E(11-1)-1167. 22p. Dep. NTIS $3.50.

The major effort in the high-energy nuclear chemistry program was the study of cross sections and kinematic properties of products formed from the interaction of 1- to 300-GeV protons with heavy- (Bi and U) and medium-mass (Cu, Ag) nuclei. The products studied ranged in mass from approximately 20 to that of the target nucleus. Except in the case of near-target product nuclei (DELTA A approximately 10 to 20), no substantial change in cross section or recoil properties was observed at 300 GeV from those measured at 11.5 GeV. New experiments are in progress to relate the production mechanisms of selected products to fundamental particle interactions and the production of exotic particles. Extensive preparations were made for another experiment to be performed soon at higher intensity on the search for polyneutron aggregates at the LAMPF Accelerator. Work is continuing on the use of stable isotope tracers (methane-20 and 21) for the study of long-range transport and diffusion phenomena in the atmosphere. A collaborative effort on the study of extraterrestrial objects (meteorites and lunar samples) is continuing. The work has involved correlations among trace and minor elements, the evolution of the lunar regolith, differentiation of lunar magmas, and a study of lunar agglutinates. (auth)

15901 (LYCEN-7501) ANNUAL REPORT, 1974. (Lyon-1 Univ., 69-Villeurbanne (France). Inst. de Physique Nucleaire). 1974. 56p. (In French). Dep. NTIS (US Sales Only) $4.50.

This annual report contains sections on theoretical nuclear physics, reaction mechanisms, nuclear spectroscopy, nuclear chemistry, "near-nuclear" physics (ion-solid interactions, photoelectron spectroscopy, studies of amorphous semiconductors), and work of visiting groups. A list of publications is also provided. (RWR)

15902 UNFOLDING OF PHYSICAL SPECTRA BY SEQUENTIAL BAYES METHODS. I. Linear Spline Models. Mendes, M.; de Polignac, C. (Institut Max von Laue-Paul Langevin, 38-Grenoble (France)); Delestre, C. (Mathematics Department, University of Sherbrooke, Sherbrooke (P.Q)., Canada). Nucl. Instrum. Methods; 127: No. 3, 405-411(15 Aug 1975).

Spline models are developed to correct smearing effects (unfolding) due to instrument resolution in measured spectra of neutron or X-ray scattering. Sequential algorithms are studied; the a-priori information has been included applying Bayes methods. (NL)

15903 UNFOLDING OF PHYSICAL SPECTRA BY SEQUENTIAL BAYES METHODS. II. Estimation of Parameters in Non-linear Models. Mendes, M. (Faculdade de Engenharia da Unicamp, Caixa Postal 1170, 13100 Campinas, S. P. Brazil); de Polignac, C. (Institut Max von Laue-Paul Langevin, 38-Grenoble (France)). Nucl. Instrum. Methods; 127: No. 3, 413-419(15 Aug 1975).

After the first steps of unfolding described in part 1 and including other physical information, an analytical model of the spectra can often be made, so that the problem of estimating non-linear parameters is posed. The technique of the extended Kalman filter has been applied to this situation. (NL)

15904 ESTIMATION OF MULTIPLE COINCIDENCES. Vincent, C. H. (UKAEA Weapons Group, Aldermaston. Atomic Weapons Research Establishment). Nucl. Instrum. Methods; 127: No. 3, 421-427(15 Aug 1975).

In this paper, the author investigates corrections of a higher order than those customarily included in the estimation of multiple coincidences. A simple system of notation is developed to enable the many complex occurrences that may need to be taken into account to be clearly described and identified. By way of an example, an exact model is specified that corresponds closely to an actual 4-channel counting system now being commissioned and an analysis of 2-fold and 3-fold coincidences based on this model is given. The resulting equations show that some modifications of the currently accepted terms are required for the highest accuracy. (NL)

15905 EFFECTS OF APPARATUS INSTABILITY ON THE MEASUREMENT ACCURACY FOR β AND γ SPECTRA. Babenkov, M. I.; Bobykin, B. V.; Zhdanov, V. S.; Petukhov, V. K. (Inst. of Nuclear Physics, Alma-Ata, USSR). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 3, 108-112(1975).

From 25th all-union conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1975). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 3, 591-596(1975).

The effects of apparatus instability on the error of measurement for γ spectra using γ spectrometers and electron spectra using β spectrometers is considered. The estimates provide conclusions on the apparatus instability such that there will be no appreciable spectrum distortion. (auth)

15906 CONCERNING THE PROBLEM OF STATISTICALLY OPTIMAL HANDLING OF SPECTRA. Gopych, P. M.; Zalyubovskii, I. I.; Ehler, G. (Kharkov State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 3, 84-92(1975).

From 25th all-union conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1975). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 3, 564-572(1975).

For the considered mathematical model of a handled spectrum the algorithm for statistically optimal detection of a peak in the presence of background and an arbitrary number of interfering peaks is obtained in general form, and the probabilities of false and true detection are determined. Obtaining the same characteristics for a more complicated spectrum model, which takes account of not only random variations in the amplitudes of the peaks but also in their positions and half-widths, within the framework of the approach used here is difficult because it leads to integrals that are convergent in the random parameters and are not integrable in elementary functions. Nevertheless, in principle, such characteristics may be obtained for each specific function that describes the shape of a peak by using numerical integration. (auth)

Neutron Interactions with Matter

Refer also to abstracts 16040-16042, 16049, 16474, and 16484.

15907 (BNL-NCS-50451, pp 156-162) COMMENTS ON ^{238}U NEUTRON WIDTH EVALUATIONS. Derrien, H. (CEN, Saclay, France). Mar 1975.

From Proceedings of ^{238}U resonance capture; Upton, New York, USA (18 Mar 1975).

In seminar on the ^{238}U resonance capture. (Brookhaven National Lab., Upton, N.Y. (USA)).

Two sets of experimental transmission data for ^{238}U are compared. It is indicated that it is possible to improve the evaluation of ^{238}U resonance parameters by checking very carefully the existing sets of experimental data.

15908 (BNL-NCS-50451, pp 189-199) INTERFERENCE SCATTERING EFFECTS ON INTERMEDIATE RESONANCE ABSORPTION AT OPERATING TEMPERATURES. Goldstein, R. Mar 1975.

From proceedings of ^{238}U resonance capture; Upton, New York, USA (18 Mar 1975).

In seminar on the ^{238}U resonance capture. (Brookhaven National Lab., Upton, N.Y. (USA)).

Resonance integrals may be accurately calculated using the intermediate resonance (IR) approximation. Results are summarized for the case of an absorber with given potential scattering cross sections and interference scattering parameter admixed with a non absorbing moderator of given cross section and located in a narrow resonance moderating medium. From the form of the IR solutions, it is possible to make some general observations about effects of interference scattering on resonance absorption. 2 figures. (SDF)

15909 (BNL-NCS-50451, pp 200-203) INTERACTIVE APPROACHES TO EVALUATING METHODS AND DATA FOR SELF-SHIELDED RESONANCE ABSORPTION. Becker, M. (Rensselaer Polytechnic Inst., Troy, NY). Mar 1975.

From proceedings of ^{238}U resonance capture; Upton, New York, USA (18 Mar 1975).

In seminar on the ^{238}U resonance capture. (Brookhaven National Lab., Upton, N.Y. (USA)).

A variety of options useful in the construction of data files to be compared, applying modifications to a data file, calculating and displaying the consequences of these modifications, etc., have been automated through the Rensselaer Interactive Graphics Analysis System (RIGAS). It is likely that this approach would be desirable for dealing with the self-shielded resonance integral over both resolved and unresolved resonances. (SDF)

15910 (BNL-NCS-50451, pp 204-214) EFFECTS OF THE FREE-GAS, SLOWING-DOWN MODEL ON RESONANCE CROSS

SECTIONS IN ^{238}U. Karam, R. A. (Georgia Inst. of Tech., Atlanta). Mar 1975.

From proceedings of ^{238}U resonance capture; Upton, New York, USA (18 Mar 1975).

In seminar on the ^{238}U resonance capture. (Brookhaven National Lab., Upton, N.Y. (USA)).

Concentrating on the slowing-down process, it is shown that the free gas model for crystalline ^{238}U would produce large error in the effective broad group resonance cross section. 2 tables, 3 figures. (SDF)

15911 (BNL-NCS-50451, pp 222-254) ENDF/B-IV THERMAL REACTOR LATTICE BENCHMARK ANALYSIS WITH MONTE CARLO RESONANCE TREATMENT. Rothenstein, W. (Brookhaven National Lab., Upton, NY). Mar 1975.

From proceedings of ^{238}U resonance capture; Upton, New York, USA (18 Mar 1975).

In seminar on the ^{238}U resonance capture. (Brookhaven National Lab., Upton, N.Y. (USA)).

The results for the TRX benchmarks suggest that the epithermal capture of ^{238}U is overpredicted to some extent by the present ENDF/B-IV data. However, the discrepancy is smaller than was reported in the past and amounts approximately to 0.4 barns of shielded resonance integral. After reduction of the ^{238}U shielded resonance integral by about 0.4 barns quite good agreement of the parameters rho_{28}, $delta_{25}$, $delta_{28}$, and C with experimental values is obtained. These parameters were measured at the center of the core. The values of k/sub eff/ are less than unity, especially for the tightest lattice where the discrepancy remains more than 1 percent. The multiplication factor relates to the assembly as a whole and part of its underprediction may be due to the fact that asymptotic reactor theory in the lattice analysis code is compared with experiments on assemblies with rather small cores. 6 tables, 1 fig. (auth)

15912 (RL-75-095) CONDENSED MATTER RESEARCH USING PULSED NEUTRON SOURCES: A BIBLIOGRAPHY. Mildner, D. F. R.; Stirling, G. C. (Science Research Council, Chilton (UK). Rutherford Lab.). May 1975. 34p. Dep. NTIS (US Sales Only) $5.00.

This survey lists published papers concerning a) the production of high intensity neutron pulses suitable for thermal neutron scattering research, b) moderating systems for neutron thermalization and pulse shaping, c) techniques and instrumentation for diffraction and inelastic scattering at pulsed sources, and d) their application to research problems concerning the structural and dynamical properties of condensed matter. Papers which deal with the white beam time-of-flight technique at steady state reactors have also been included. (auth)

15913 RESONANCE EFFECTS BY RESONANCE GROUP PARAMETERS. Segaev, M. (Soreq Nuclear Research Centre, Yavne, Israel). pp 503-512 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-

The concept of resonance group parameters is explained. The use of these parameters instead of shielding (structure) factors alleviates the problems of σ-interpolation and σ-ambiguity in the application of the latter. Resonance group parameters of U-235, U-238, Pu-239, Pu-240, Pu-241 and Pu-242 are given for Bondarenko groups 10 to 25. (6 tables) (auth)

15914 CROSS-SECTION SENSITIVITIES, ADJUSTMENTS AND ALL THAT. Wagschal, J. J. (Hebrew Univ., Jerusalem); Ya'ari, A.; Yeivin, Y. pp 536-550 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

It is demonstrated that the sensitivities approach to cross section adjustment unavoidably leads to adjustment by least squares. The relative weight of integral with respect to differential data is introduced and the advantage of its use as a free parameter is discussed. As an illustration, the proposed procedure is applied to the ENDF/B-3 library and several Los Alamos critical assemblies. (auth)

15915 EFFECTIVE-MASS TREATMENT OF NEUTRON SLOWING DOWN. Sengupta, A. (Indian Inst. of Tech., Kanpur). J. Phys., D (London); 8: No. 14, 1624-1631(1 Oct 1975).

A new concept of an effective mass in the slowing down of fast neutrons is introduced. This concept, by accounting for absorption in an increased effective mass, places scattering in the presence of absorption on a formally equivalent basis with pure scattering. Thus absorption in slowing-down theory need not be considered as a separate phenomenon, but only as a generalized form of pure scattering. For a mixture, the effective mass includes the effect of absorption in an effective single element. A model of the moderation process is considered which allows a description of the mixture by the simpler single-element equations. (auth)

15916 HIGH-ORIENTED PYROLYTIC GRAPHITE AS NEUTRON FILTER. I. Cold Neutron Filter. Saad, M.; Fischer, C. O. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (F. R. Germany)); Heller, H. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Terperhude (F. R. Germany)). Atomkernenergie; 26: No. 2, 91-92(1975).

1 fig.; 1 tab.; 15 refs.

The total cross section of high-oriented pyrolytic graphite (HOPG) has been measured parallel and perpendicular to the c-axis. By transmission parallel to the c-axis HOPG is transparent for cold neutrons with wavelength $\lambda > \lambda_{100} = 4.25$ A (energies < 4.53 MeV) and therefore suitable as filter for cold neutrons. The properties of this filter are discussed in comparison with a beryllium filter. (DE)

15917 RELATION BETWEEN THE CONCENTRATION DEPENDENCE OF THE AVERAGE NEUTRON CROSS SECTION OF MOLECULES AND ATOMS IN BINARY SOLUTIONS. Suszkin, A. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F. R. Germany)). Atomkernenergie; 26: No. 2, 84-86(1975).

7 figs.; 2 refs.

The concentration dependence of the neutron cross-sections of molecules in solutions is compared with the concentration dependence of the cross section of average atoms. The difference in concentration dependence of the cross section of molecules and atoms is due to the concentration dependence of the number of the average atoms per average molecule. The concentration dependence of the cross section is correlated with that of the corresponding particle number per cm^3. This correlation is specific for any solution. A relation for the concentration dependence of the transmission of a solution is given. (DE)

15918 COMMENT ON ATTENUATION OF 14-MeV NEUTRONS THROUGH CONCRETE SHIELDS. Chilton, A. B. (Univ. of Illinois, Urbana). Health Phys.; 29: No. 5, 813-814(Nov 1975).

Data presented in a recent paper by Bozyap and Day on the attenuation of 14 MeV neutrons in shields of concrete and paraffin wax, are considered in respect to the concrete results. It is suggested that the results presented in the paper give little reason for believing that either the diffusion or the elementary removal approaches will by themselves account precisely for the penetration behavior of 14.7 MeV neutrons through concrete. At best, the equations presented must be considered to have a strong empirical character; and the manner in which such results are to be utilized for future concrete shield analysis is uncertain. (UK)

Nuclear Properties and Reactions, A ≤ 5

Refer also to abstracts 14896, 15719, 15782, 15949, and 16094.

15919 (IPNO-T-76-01) THEORETICAL CONTRIBUTION TO NUCLEON-DEUTERON SCATTERING AT MEDIUM ENERGY. Analysis of the Off-Shell Amplitudes of the N-N Interaction. Interpretation of p + d → p + p + n Experiences at 155 MeV. l'Huillier, M. (Paris-7 Univ., 75 (France)). 1974. 140p. (In French). Dep. NTIS (US Sales Only) $7.00.

Thesis.

The calculation program for the off-shell elements of the N-N scattering matrix was established for various types of potential and the behaviors were analyzed. The discussion is oriented by the fact that these functions are elements in the calculation of the p + d reaction. The off-shell amplitudes obtained by realistic potentials were compared and an attempt was made to systematize the characteristics of these amplitudes with the aid of a simple model. The Faddeev formalism for nucleon-deuteron scattering was considered and only the first and second order terms were retained. The first-order term was calculated exactly as the product of an off-shell N-N amplitude by a probability density in the deuteron. The variation corresponding to the selection of several N-N potentials were analyzed. The quality of the usual approximations was examined. After this analysis of the model the results obtained for the kinematic conditions of the Orsay experiments were presented and discussed. A critical analysis was made of the model on the basis of the comparison of experimental and theoretical results. (JSR)

15920 ENERGY STRAGGLING OF PROTONS IN CARBON. Rickards, J. (Universidad Nacional Autonoma de Mexico, Mexico City). Nucl. Instrum. Methods; 127: No. 3, 397-403(15 Aug 1975).

Using a strong resonance in the elastic scattering of protons from carbon at 460 kev, energy straggling has been measured by observing backscattering spectra from thick carbon targets of different densities. The straggling depends on the incident energy, which determines the depth at which the resonant scattering occurs. The data are fit by a $\sqrt{t}$ behavior, but values are 4 to 7 times higher than predicted by Bohr theory. There is a target effect that could be attributed to channeling, porosity or surface roughness. (NL)

15921 ELASTIC SCATTERING OF ^{10}B ON ^{10}B IN THE ENERGY RANGE FROM 4 TO 15 MeV. Dietl, G.; Gruber, G.; Schmidt-Bocking, H.; Bethge, K. (Heidelberg Univ. (F. R. Germany). 2. Physikalisches Inst.). Nucl. Phys., A; 250: No. 2, 322-332 (6 Oct 1975).

Angular distributions (at $E_{c.m.}$ = 4, 6.5 and 10.5 MeV) and excitation functions (at 30°, 60° and 90°) are given for the elastic scattering of ^{10}B on ^{10}B. The results of an optical model (OM) analysis are presented and discussed. In the energy range covered the Sommerfeld parameter varies from 4.4 to 2.3. (NL)

15922 A METHOD TO DETERMINE CRITICAL ANGULAR MOMENTA IN LIGHT NUCLEI. Klapdor, H. V.; Reiss, H.; Rosner, G. (Max-Planck-Institut fuer Kernphysik, Heidelberg (F. R. Germany)). Phys. Lett., B; 58: No. 3, 279-282(15 Sep 1975).

A method is presented to determine with high accuracy critical angular momenta in light nuclei (A ~ 40) from the statistical model analysis of relative experimental cross sections in high-spin selective heavy-ion compound reactions. The critical angular momentum in the reaction ^{10}B(^{12}C,d)^{20}Na at E_{lab} = 45 MeV is determined to be $J_{crit} = 14 \pm 1$. (NL)

15923 THE IMPORTANCE OF SPIN FLIP IN PION CHARGE EXCHANGE REACTIONS. Sparrow, D. A. (Colorado Univ., Boulder (USA). Nuclear Physics Lab.). Phys. Lett., B; 58: No. 3, 309-312(15 Sep 1975).

Pion scattering from ^{3}He is investigated in the context of a simple reaction model. It is shown that for energies below around 200 MeV the spin flip mode can dominate the ^{3}He(π^-, π^0)^{3}H differential cross section at most angles, and contribute up to 50% of the total charge exchange cross section. (NL)

15924 QUASI-FREE ELECTRON SCATTERING AND THE α-d CLUSTER STRUCTURE OF ^{6}Li. Vinciguerra, D. (Univ., Catania, Italy); Modica, E.; Palmeri, A.; Julien, J.; Samour, C.; Genin, J. P. Lett. Nuovo Cim.; 14: No. 9, 333-337(1 Nov 1975).

An investigation is made of the dependence of the shape of the intercluster momentum distribution $G^2(p)$ in quasi-free scattering on the choice of the functional form of the radial equation and on the values of its parameters, by imposing the condition that any comparison be made for the same value of the root mean square intercluster distance. Specifically, the values of the full width at half maximum of $G^2(p)$ and its maximum value $G^2(0)$ are evaluated. Calculations have been made for both Eckart and square well wave functions. (SDF)

15925 THREE-BODY MODEL OF DEUTERON SCATTERING AND BREAKUP. Farrell, J. P. Jr. Pittsburgh; Univ. of Pittsburgh (1974). 129p. University Microfilms Order No. 75-18,234. Thesis (Ph. D.).

A three-body model of deuteron-nucleus scattering is presented. In this model, the three-body wavefunction PSI(n,p) is broken into two parts, as suggested by Johnson and Soper, in a fashion determined by the neutron-proton relative angular momentum. The model emphasizes the part PSI/sub o/ of the full three-body wavefunction in which the neutron and proton are in an S-state of relative motion. The component PSI/sub o/ is believed to have very large overlap with PSI(n,p) in the interior and surface regions of the target nucleus; it contains both the elastically scattered deuteron center of mass wavefunction, which is emphasized in the DWBA theory, and also the S-wave breakup wavefunctions discussed by Johnson and Soper. An analysis of the component PSI/sub o/ of the full three-body wavefunction thereby provides an extended theory of which DWBA is a special case. A coupled channels formulation is employed to calculate the wavefunction PSI/sub o/. These equations couple the neutron-proton center of mass wavefunctions, which depend on the continuous momentum index k. A simple WKB approximation is introduced to take account of the long range coupling among breakup channels; this leads to the definition of a pair of potential matrices W and S that describe the coupling among breakup channels. In order to examine the general properties of the coupling matrices W and S and the three-body wavefunction PSI/sub o/, the coupled channels theory is applied to the case of 22.9 MeV deuterons incident on a target nucleus of mass number A approximately 40. The Coulomb interaction is ignored and a local Gaussian form-factor is chosen for both the real and imaginary parts of the nucleon-nucleus optical potential. It is found that a rather broad spectrum of n-p continuum states is excited in this model and that states with low n-p relative energy are suppressed because of their low phase space density. The results cast some doubt on the adiabatic theory of Johnson and Soper, since their treatment emphasizes breakup into states of low n-p relative energy. (Diss. Abstr. Int., B)

15926 THE HALF-LIFE OF ^{10}Be AND THE RENORMALIZATION OF THE AXIAL-VECTOR COUPLING CONSTANT. Szybisz, L. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Experimentelle Kernphysik). Z. Phys., A; 273: No. 3, 277-281(Jul 1975).

1 tab.; 21 refs.

The unique second-forbidden β-transition 0^+(555.9 keV β^-)$^{3+}$ of ^{10}Be was analyzed in detail. The half-life $T_{\frac{1}{2}}$ was calculated in the best possible way. Special attention was bestowed on the higher order corrections and a careful treatment of the errors performed. The theoretical half-life was obtained to be $T_{\frac{1}{2}} = (1.31 \pm 0.15) \times 10^6$ yr. Although this result, within the uncertainties appears to be in agreement with the experimental value $T_{\frac{1}{2}} = (1.59 \pm 0.16) \times 10^6$ yr, its mean value is slightly smaller than that of the experimental. This fact is attributed to the renormalization of the axial vector coupling constant C_A. The phenomenological magnitude of this renormalization, $p_{SF}^{PC} = 0.923 \pm 0.096$, was found to be in excellent agreement with the "fundamental" renormalization derived from the PCAC hypothesis and the exchange effects in the pionic vertex, namely p_F approximately equal to 0.93. (DE)

15927 POLARIZATION EFFECTS IN THE FINAL-STATE INTERACTION REGION OF THE *p-d* BREAKUP REACTION. Rad, F.N.; Conzett, H.E.; Roy, R.; Seiler, F. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). Phys. Rev. Lett. 35: No. 17, 1134-1136 (27 Oct 1975).

The angular distributions of the vector analyzing power have been measured in the reactions ^{2}H(*p,p*) *np* and ^{1}H(*d,p*) *np* at 22.7 and 45.4 MeV, respectively, corresponding to the same center-of-mass energy. Significant analyzing powers were found in the production of final-state *np* pairs with low relative energies, and the angular distributions show a remarkable similarity to those of the corresponding elastic scattering. (auth)

Nuclear Properties and Reactions, 6 ≤ A ≤ 19

Refer also to abstracts 15424, 15719, 15922, and 16080.

15928 (CEA-N-1791, pp 148-150) MEASUREMENT FOR (e,e'd) AND (e,e'α) REACTIONS WITH ^{6}Li AND ^{9}Be. Genin, J. P.; Julien, J.; Letourneau, R.; Mougeot, A.; Palmeri, A.; Rambaut, M.; Samour, C.; Vinciguerra, D. [nd]. (In French)

In Department of Nuclear Physics. Progress report, 1 October 1973–30 September 1974. (CEA Centre d'Etudes Nucleaires de Saclay, 91–Gif-sur-Yvette (France). Dept. de Physique Nucleaire).

The quasi-free reaction ^{6}Li(e,e'α) and ^{6}Li(e,e'd) were studied at T_0 approximately equal to 556 MeV and q = 2.15 fm^{-1} and the reaction ^{9}Be(e,e'α) at the same energy and at q = 1.53 fm^{-1}. The momentum distributions of the emitted clusters were obtained in PWIA. (FR)

15929 (CSNSM-R-75-1) CROSS SECTIONS FOR THE PRODUCTION OF Li AND Be ISOTOPES IN CARBON TARGETS IRRADIATED BY 300 GeV PROTONS. Raisbeck, G. M.; Lestringuez, J.; Yiou, F. (Centre National de la Recherche Scientifique, 91–Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse). 1975. 3p. INIS.

From 14th international cosmic ray conference; Garching, near Muenchen (F. R. Germany) (15 Aug 1975).

Cross sections for the production of Li and Be isotopes in carbon targets irradiated by 300 GeV protons were measured by mass spectrometry. The results are compared with lower energy measurements and discussed in terms of the variation of the cosmic ray L/M ratio in this energy region. (FR)

15930 (CSNSM-R-75-7) EXCITATION FUNCTIONS FOR SOME NUCLEAR REACTIONS RELEVANT TO THE COSMIC RAY PROPAGATION PROBLEM. Raisbeck, G. M.; Yiou, F. (Centre National de la Recherche Scientifique, 91–Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse). 1975. 4p. INIS.

From 14th international cosmic ray conference; Garching, near Muenchen, F. R. Germany (15 Aug 1975).

Cross sections for the production of a number of radionuclides from targets of O, Mg, Si, Fe and N; irradiated by protons of 1, 2, 3, and 25 GeV were measured. The results are discussed in connection with the "asymptotic" energy at which nuclear cross sections (and thus cosmic ray secondary production) can be assumed to become constant. This energy is seen to depend on the mass of the target and the product being considered. (FR)

15931 (FRNC-TH-547) STUDY OF TWO-STEP MECHANISMS IN THE $^{12}C(p,d)^{11}C$ REACTION AT 45 MeV. Couvert, P. (Grenoble-1 Univ., 38 (France)). 1974. 77p. (In French). INIS.

An attempt was made to find the nuclear reaction mechanisms explaining the intensity and behavior of the cross sections in the $^{12}C(p,d)^{11}C$ reaction at 45 MeV. First, the conventional interpretation of the experimental data leads to two closely related conclusions. The behavior of the cross-sections measured cannot be explained without including the intermediate stage of collective 2^+ ^{12}C excitation or accounting for its possible interference with the direct capture of a neutron. The relative intensity of the different mechanisms is directly bound up with the value of the nuclear structure parameters of the wave function adopted. As a result this study is found to be an excellent wave function test and the results obtained seem to prove that the wave function calculated by Clegg for ^{11}B is also suitable for ^{11}C. Next a two-stage process was introduced, using inelastic deuteron scattering on ^{11}C as the intermediate stage. The problem which then arises is to determine the deformation parameters of the final nucleus in its different excitation states. The model adopted is in fact very crude and only gives quantitative information on the physical reality of such a process. Some improvement is shown to be obtained by finite range and non-local potential corrections. It is observed that track-transitions, which correspond in fact to new processes interfering with those already introduced play an important part. The most realistic way to treat the problem is thus to make an exact calculation within the coupled equation system, keeping strictly to physically justified hypotheses. (FR)

15932 (FRNC-TH/553) IONIZED CARBON INVESTIGATION (SPECTROSCOPIC TERMS, RADIATIVE LIFETIMES) USING ION BEAMS. Buchet-Poulizac, M. C. (Lyon-1 Univ., 69 (France)). 1974. 210p. (In French). INIS.

The spectra of carbon in all its ionization states were studied by the beam-foil technique, from the far ultraviolet (30A) to 6000A. This excitation process gives the spectra of strongly charged ions with great intensity and favors population of the high levels of these ions. It has led to new identifications, mainly C IV, C V, and C VI spectra. The results of radiative lifetime measurements are given for many levels of C II, C III, C IV and C V. The chief cause of error on these measurements is the cascade phenomenon. Various methods of decay curve analysis accounting for these processes were examined and showed that lifetime values of precision better than 10% can be obtained. The transition probabilities were estimated from the lifetime measurements whenever possible. The spectra obtained in the laboratory were compared with those observed in the Wolf-Rayet stars of the carbon sequence. The similarities and dissimilarities which appear yield information on the physical conditions prevailing in the atmosphere of these stars. (FR)

15933 (IPNO-T-75-03) EXPERIMENTAL STUDY AND ANALYSIS OF THE (^{3}He,t) CHARGE EXCHANGE REACTION AT 217MeV. Willis, N. (Paris-11 Univ., 91-Orsay (France). Inst. de Physique Nucleaire; Paris-11 Univ., 91-Orsay (France)). 1975. 100p. (In French)

Charge exchange reactions have been extensively studied and a great amount of experimental data are available below 70 MeV incident energy. An experiment at 217 MeV ^{3}He energy was undertaken in order to investigate the dependence of the reaction mechanism on the incident energy. The experimental set-up is described. The performance of the E detector — a thick Ge(Li) diode — are studied. The energy resolution was good enough to investigate light nuclei: ^{9}Be, ^{10}B, ^{11}B and ^{12}C. Then a microscopic DWBA calculation was carried out in order to extract information about the isospin dependent parts of the nucleon-projectile interaction (range and strength). The importance of the tensor term has been pointed out to account for the angular distribution of non-natural parity transitions. The agreement with the experimental results is good except when the transferred angular momentum is J = 2. Some two step-processes which were seen to be important at lower incident energy have been calculated; compared with experimental results, (^{3}He-α-t) and (^{3}He-^{3}He'-t) are always important at 217 MeV whereas (^{3}He-d-t) is seen to be negligible. Other intermediate states may be perhaps be introduced in the calculation but it is already possible to conclude that multistep processes are important even at high energies. (FR)

15934 HYDROGEN BURNING OF ^{17}O IN THE CNO CYCLE. Rolfs, C.; Rodney, W. S. (California Inst. of Tech., Pasadena (USA)). Nucl. Phys., A; 250: No. 2, 295-308(6 Oct 1975).

The direct capture process in the $^{17}O(p,\gamma)^{18}F$ reaction has been used to determine the reduced proton widths of the states in ^{18}F near the proton threshold. The observed upper limits on these widths are up to factors of 60 smaller than the previously assumed values implying a corresponding reaction of the stellar reaction rate for the $^{17}O(p,\alpha)^{14}N$ reaction. These results together with results from previous work lead to the conclusion that the CNO cycle is tricycling with the reactions $^{17}O(p,\gamma)^{18}F(\beta^+\nu)^{18}O(p,\alpha)^{15}N$ as the third cycle. The implications of these results on the equilibrium abundances of the elements synthesized in this cycle are discussed. (NL)

15935 INTERFERING PROTON AND NEUTRON TRANSFER IN THE REACTION $^{13}C(^{15}N,^{14}N)^{14}C$. Gamp, A.; Braun-Munzinger, P.; Gelbke, C. K.; Harney, H. L.; Bohlen, H. G.; Bohne, W.; Hildenbrand, K. D.; Kuzminski, J.; von Oertzen, W.; Tserruya, I. (Max-Planck-Institut fuer Kernphysik, Heidelberg (F. R. Germany)). Nucl. Phys., A; 250: No. 2, 341-350(6 Oct 1975).

The reaction $^{13}C(^{15}N,^{14}N)^{14}C$ leading to the ground state and first excited state in ^{14}N has been measured at incident energies of 30, 32, and 45 MeV. For the isomultiplet channel the data are symmetric about $\theta = \frac{1}{2}\pi$ as predicted by the "Barshay-Temmer" theorem. The angular distributions for both exit channels show a minimum at $\theta = \frac{1}{2}\pi$. The angular distributions of the transition to the ground state of ^{14}N are nearly symmetric. The slight asymmetry can be explained with a model of two interfering transfer reactions. Recoil effects do not give rise to significant changes in the shapes of the angular distributions. (NL)

15936 NUCLEAR REACTIONS BETWEEN OXYGEN ISOTOPES. Kalinsky, D.; Melnik, D.; Smilansky, U.; Trautner, N.; Watson, B. A. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Nuclear Physics); Horowitz, Y.; Mordechai, S. (Ben-Gurion Univ. of the Negev, Beersheba (Israel)); Baur, G.; Pelte, D. (Max-Planck-Institut fuer Kernphysik, Heidelberg (F. R. Germany)). Nucl. Phys., A; 250: No. 2, 364-380(6 Oct 1975).

Elastic and inelastic cross sections have been measured for the system $^{16}O + ^{17}O$ at c.m. energies from 12.5 to 15.5 MeV and for $^{16}O + ^{18}O$ at c.m. energies from 12 to 20 MeV at angles between 60° and 125°. Position-sensitive detectors were employed using the kinematic coincidence technique. The data have been analyzed with particular attention to the contributions of multiple-exchange processes. (NL)

15937 SELFCONSISTENT CALCULATIONS OF HEAVY ION POTENTIALS, DEMONSTRATED FOR $^{16}O + ^{16}O$. Zint, P. G.; Mosel, U. (Giessen Univ. (F. R. Germany). Inst. fuer Theoretische Physik). Phys. Lett., B; 58: No. 3, 269-272(15 Sep 1975).

Hartree-Fock calculations using the Skyrme-force were performed for the system ^{32}S yields $^{16}O + ^{16}O$ with a constraint on the center of mass distance. The resulting energy curve yields the right deformation of the ground state of ^{32}S as well as the correct height for the interaction barrier. It also exhibits a second minimum. A simple interpretation for this is presented in terms of the single particle level scheme. The implications of these results for experimentally observed cross sections are discussed. (NL)

15938 DIRECT AND RESONANCE PROCESSES IN $^9Be(d,p_{0,1})^{10}Be$ AND $^9Be(d,t_0)^8Be$ AT LOW ENERGIES. Zwieglinski, B. (Institute of Nuclear Research, Warsaw (Poland)); Saganek, A.; Sledzinska, I.; Wilhelmi, Z. (Warsaw Univ. (Poland). Instytut Fizyki Doswiadczalnej)). Nucl. Phys., A; 250: No. 1, 93-105 (29 Sep 1975).

Angular distributions for $^9Be(d,p_0)^{10}Be$, $^9Be(d,p_1)^{10}Be$ and $^9Be(d,t_0)^8Be$ have been measured at 21 energies in the range from 0.9 to 3.1 MeV. The coefficients of expansion into Legendre polynomials of the experimental data and the DWBA cross sections calculated with energy-independent spectroscopic factors, have been compared. Arguments based on this comparison and the available data below 0.9 MeV are presented in favor of the hypothesis that DWBA fails to predict the energy dependence of the matrix elements associated with the deuteron p-wave. A broad resonance ($E_x(^{11}B) = 17.3$ MeV) strongly excited in the $^9Be(d,p_1)^{10}Be$ reaction at $E_d = 1.85$ MeV is suggested to be responsible for the discrepancies. It is suggested that the narrow 16.43, 17.70 and 18.37 resonances recently observed in ^{11}B have isospin T = $\frac{3}{2}$. (NL)

15939 TRANSFER REACTIONS INDUCED BY ^{12}C ON ^{18}O AND ^{26}Mg AT 46 MeV. Conjeaud, M.; Harar, S.; da Silveira,

E. F.; Volant, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Service de Physique Nucleaire a Basse Energie). Nucl. Phys., A; 250: No. 1, 182-210(29 Sep 1975).

Angular distributions of levels observed in the $^{18}O(^{12}C,^{10}Be)^{20}Ne$, $^{26}Mg(^{12}C,^{11}B)^{27}Al$, $^{26}Mg(^{12}C,^{10}Be)^{28}Si$ and $^{26}Mg(^{12}C,^{9}Be)^{29}Si$ reactions have been measured at 46 MeV incident energy; some of them show a strong oscillating pattern. Spectroscopic factors extracted from a DWBA analysis of the $(^{12}C,^{11}B)$ 1p transfer with the LOLA code, are consistent with those from $(^{3}He,d)$. The influence of recoil effects on both the shapes of the angular distributions and the absolute magnitudes of cross sections have been studied for $(^{12}C,^{11}B)$ and $(^{16}O,^{15}N)$. The 2p transfer reactions leading to ^{20}Ne and ^{28}Si have been analyzed using realistic microscopic wave functions. Effects of configuration mixing on both the relative and the absolute cross sections are presented. The validity of approximating the 2p wave function by an Os cluster component is discussed and some nuclear structure information is derived. The $^{26}Mg(^{12}C,^{9}Be)^{29}Si$ reaction populates preferentially the same levels as the $^{28}Si(d,p)^{29}Si$ reaction. A DWBA analysis using a ^{3}He cluster form factor gives relative spectroscopic strengths close to those derived from (d,p) stripping. (NL)

15940 FORM FACTORS FOR ROTATIONAL LEVELS IN ^{12}C, ^{16}O, ^{28}Si AND ^{40}Ca. Lezuo, K. J. (Mainz Univ. (F. R. Germany). Inst. fuer Kernphysik). Z. Naturforsch., A; 30: No. 8, 1018-1022(Aug 1975).

4 figs.; 16 refs.

We support the proposed ground state rotational bands in ^{12}C, ^{16}O, ^{28}Si and ^{40}Ca by calculating the form factors for the electro-excitation within a simple model. The model introduces two parameters for the size and the surface thickness of these nuclei and allows the prediction of the transition probabilities and form factors within the rotator model. The model unambiguously predicts the sequence of rotational levels 0^+, 3^+, 4^+... for ^{16}O and ^{40}Ca, and 0^+, 2^+, 4^+... for ^{12}C and ^{28}Si in agreement with the experiment. The comparison of the calculated form factors with the experimental data shows excellent agreement in the cases ^{28}Si and ^{40}Ca and is less satisfactory in the cases ^{12}C and ^{16}O. (DE)

15941 SECONDARY ELECTRON YIELD FROM VARIOUS MATERIALS UNDER THE IMPACT OF LIGHT IONS AT HIGH ENERGIES. Beck, H. P.; Langkau, R. (Hamburg Univ. (F. R. Germany). 1. Inst. fuer Experimentalphysik). Z. Naturforsch., A; 30: No. 8, 981-985(Aug 1975). (In German)

7 figs.; 5 refs.

The backward emission of secondary electrons from thick targets of graphite, aluminum, copper, molybdenum and tantalum under the impact of protons, deuterons, ^{3}He-ions and α-particles has been measured for incident energies in the MeV-range. The data are discussed within the scope of theoretical considerations based on low-energy studies taking into account the contribution due to delta-rays. (DE)

15942 MATHEMATICAL FORMALISM AND A PROGRAM FOR ANALYZING THE ELASTIC SCATTERING OF POLARIZED PROTONS BY NUCLEI HAVING SPIN $3/2$. Mashkarov, Yu. G.; Chegoryan, M. A.; Zalyubovskii, I. I. (Kharkov State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 3, 80-83(1975).

From 25th all-union conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1975). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 3, 560-563(1975).

A mathematical formalism is obtained for analyzing available experimental data on elastic scattering of polarized protons by the nuclei ^{7}Li, ^{9}Be, and ^{11}B for which the ground-state spin is equal to $3/2^-$ on the basis of using the multilevel multichannel approximation of R-matrix theory. (auth)

15943 SOME POLARIZATION EFFECTS IN (p(pol),p') AND (p(pol),d) ON LIGHT NUCLIDES. Plavko, A. V.; Lombard, R. M.; Mayer, B.; Kudryashov, V. I.; Gosset, J. Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 3, 120-123(1975).

From 25th all-union conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1975). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 3, 606-610(1975).

Results of polarization measurements in inelastic scattering and deuteron pickup reactions of polarized protons on light nuclei are analyzed with attention given to the relationship between polarization data and differential cross sections. ^{24}Mg is considered as an example. (4 figures) (auth)

15944 ISOBAR EXCITATION IN A COMPLEX NUCLEUS. Dillig, M.; Huber, M. G. (Erlangen-Nuernberg Univ., Erlangen (F. R. Germany). Inst. fuer Theoretische Physik). pp 80-132 of Mesonic Effects in Nuclear Structure. Proceedings. Bleuler, K. (ed.). Mannheim, F. R. Germany; Bibliographisches Institut (1975).

From symposium on mesonic effects in nuclear structure in remembrance of K. Erkelenz; Bonn, F. R. Germany (29 Jan 1974). 16 figs.; 24 refs.

The excitation of a bound nucleon into the (3,3) resonance is discussed in a particle hole model. The interaction of the Δ with the nucleons of the residual nucleus leads to a shift of the center of gravity of the nuclear excitation spectrum and possibly to narrow collective resonances, similar to the well-known giant resonances in conventional nuclear physics. With increasing mass number the excitation spectrum should exhibit some fine structure related to the ground state configuration of the target nucleus. The experimental consequences for finite nuclei and the implications for nuclear matter and neutron star matter are briefly discussed. (DE)

15945 CONTRIBUTION OF TWO-STEP MECHANISM TO THE ISOSPIN-FORBIDDEN $^{16}O(d,\alpha)^{14}N^*(0^+, T = 1)$ REACTION. Falk, W. R.; Djaloeis, A.; Wolter, H. H.; Kelleter, H. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik). Z. Phys., A; 273: No. 3, 265-267(Jul 1975).

1 fig.; 1 tab.; 19 refs.

Measurements of the isospin-forbidden $^{16}O(d,\alpha)^{14}N^*(0^+, T = 1)$ reaction have been extended to 50 MeV deuteron bombarding energy. A coupled-reaction-channels analysis of the reaction involving intermediate states in ^{15}O and ^{15}N underestimates the resonance-free region of the cross section by as much as an order of magnitude. (DE)

15946 NUCLEAR REACTIONS INDUCED BY STOPPED NEGATIVE PIONS. Engelhardt, D. (Karlsruhe Univ. (TH) (F. R. Germany). Inst. fuer Experimentelle Kernphysik). pp 24-56 of Mesonic Effects in Nuclear Structure. Proceedings. Bleuler, K. (ed.). Mannheim, F. R. Germany; Bibliographisches Institut (1975).

From symposium on mesonic effects in nuclear structure in remembrance of K. Erkelenz; Bonn, F. R. Germany (29 Jan 1974). 8 figs.; 6 tabs.; 48 refs.

The particularities of π^- absorption reactions on complex nuclei are discussed. A brief review of pion-induced reactions on nuclei and their interpretation is given. The results of the CERN (π^-,γ)-experiment on ^{9}Be, ^{10}B, ^{16}O, ^{19}F, ^{24}Mg, ^{31}P, ^{40}Ca and ^{93}Nb are presented and a tentative interpretation of this experiment is advanced. (DE)

15947 TWO-PHOTON DECAY OF THE 6.05-MeV STATE OF ^{16}O. Watson, B.A.; Bardin, T.T.; Becker, J.A.; Fisher, T.R. (Lockheed Palo Alto Research Laboratory, Palo Alto, California 94304). Phys. Rev. Lett. 35: No. 20, 1333-1336 (17 Nov 1975).

A triple-coincidence, five-parameter technique was employed to search for two-photon emission in the decay of the $^{16}O(6.05-MeV)$ state. Data were event-recorded and analyzed in parallel with events associated with decay of the $^{16}O(6.13-MeV)$ and the $^{16}O(7.12-MeV)$ states. Our measured branching ratio is $N_{\gamma\gamma}/N_{\pi} = (2.5 \pm 1.1) \times 10^{-4}$. (auth)

15948 MEASUREMENT OF THE QUADRUPOLE MOMENT OF THE FIRST EXCITED 2^+ STATE OF ^{18}O. Kleinfeld, A.M. (I. Physikalisches Institut, Universität zu Köln, Köln, West Germany); Lieb, K.P.; Werdecker, D.; Smilansky, U. Phys. Rev. Lett. 35: No. 20, 1329-1332 (17 Nov 1975).

We measured the static electric quadrupole moment (Q_2+) and B ($E2,0_1{}^+ \rightarrow 2_1{}^+$) of the first excited state of ^{18}O at 1.98 MeV. The values obtained were $(-0.19 \pm 0.02$ b) e (for the positive sign of the interference term involving the $2_1{}^+$ state) and $(0.0048 \pm 0.0002$ b^2) e^2 for Q_2+ and B ($E2,0_1{}^+ \rightarrow 2_1{}^+$), respectively. For these values the ratio $|Q_2+|/[B\ (E2,0_1{}^+ \rightarrow 2_1{}^+)]^{1/2}$ is about 3, whereas for no other nucleus does it exceed unity by more than 30%. (auth)

15949 $M1$ DECAY RATES AND SECOND-CLASS CURRENTS IN MASS 8. Nathan, A.M.; Garvey, G.T. (Princeton University, Princeton, New Jersey 08540); Paul, P.; Warburton, E.K. Phys. Rev. Lett. 35: No. 17, 1137-1140 (27 Oct 1975).

The total isovector $M1$ γ-decay rate of the 16.6–16.9−MeV doublet in ^{8}Be to the broad first excited state has been measured with the reaction $^{4}He(^{4}He,\gamma)$. A width of 4.8 ± 0.7 eV has been found. When properly interpreted, this result seems consistent with predictions of conserved vector current theory and with the absence of a second-class induced-tensor form factor. (auth)

Nuclear Properties and Reactions, $20 \leq A \leq 38$

Refer also to abstracts 15421, 15424, 15719, 15930, 15940, 15941, 15943, 15946, 15952, 15972, 15973, 15990, 15996, and 16067.

15950 LEVELS OF ^{35}Ar FROM $^{33}S(^{3}He,n)^{35}Ar$ AND $^{33}S(^{3}He,n\gamma)^{35}Ar$. Davidson, J. M.; Taylor, T.; Hutcheon, D. A.; Shep-

pard, D. M.; Olsen, W. C. (Alberta Univ., Edmonton (Canada). Nuclear Research Centre). Nucl. Phys., A; 250: No. 2, 221-226 (6 Oct 1975).

The levels of ^{35}Ar were studied with the reactions ^{33}S(^{3}He,n)^{35}Ar and ^{33}S(^{3}He,nγ)^{35}Ar. Neutron time-of-flight spectra enabled the tentative identification of a state at 5537 ± 25 keV excitation as the first T = $\frac{3}{2}$ state in ^{35}Ar. In neutron-γ coincidence measurements, the previously unreported ground-state γ-ray decay of ^{35}Ar states at 1184.2 ± 0.6, 1749.8 ± 0.9 and 2600.8 ± 1.5 keV excitation was observed. (NL)

15951 ENERGY LEVELS OF ^{28}Si. Meyer, M. A.; Venter, I.; Reitmann, D. (Potchefstroom Univ. for C. H. E. (South Africa)). Nucl. Phys., A; 250: No. 2, 235-256(6 Oct 1975).

Proton energies and strengths of (p,γ), (p,p_1), (p,p_2) and (p,$\alpha_1\gamma$) resonances of the ^{27}Al + p reaction were determined for $E_p < 2.5$ MeV. The γ-decay of 78 resonances and 46 bound levels was established and four new bound levels were found at E_x = 9793 ± 2.0, 10513.5 ± 1.0, 10884.1 ± 2.0 and 11778.8 ± 1.5 keV. The level at E_x = 11.43 MeV was found to be a doublet. Lifetimes of 25 bound levels were measured by means of the Doppler-shift attenuation technique. Angular distributions were measured at 15 resonances. (NL)

15952 LIFETIME OF THE SECOND EXCITED STATE OF ^{43}K. Bozek, E.; Gehringer, C.; Jaeger, C.; Merdinger, J. C. (Centre National de la Recherche Scientifique, 67-Strasbourg (France). Centre de Recherches Nucleaires). Nucl. Phys., A; 250: No. 2, 257-259(6 Oct 1975).

The lifetime of the 738 keV level of ^{43}K, excited by means of the ^{40}Ar(α,p)^{43}K reaction, has been deduced from the distribution of time delays between protons and decay γ-rays. The half-life, 205 ± 10 ns, favors a $J^\pi = \frac{7}{2}^-$ assignment. (NL)

15953 DOES THE CABIBBO ANGLE SOMETIMES VANISH IN NUCLEAR β-DECAY. Hardy, J. C.; Towner, I. S. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Phys. Lett., B; 58: No. 3, 261-262(15 Sep 1975).

The anomalous behavior of ^{35}Ar decay could be consistent with the suggestion of Salam and Strathdee that the Cabibbo angle vanishes at high magnetic fields. (NL)

15954 ANALYSIS OF E1 AND E2 RADIATIVE α-CAPTURE AND GIANT MULTIPOLE RESONANCES. Shikazono, N.; Terasawa, T. (Australian National Univ., Canberra. Research School of Physical Sciences). Nucl. Phys., A; 250: No. 2, 260-284(6 Oct 1975).

Experimental data on E1 and E2 radiative α-capture are analyzed by taking account of direct and semidirect processes as well as the compound process. Observed excitation functions for these reactions are reasonably well reproduced assuming the reactions take place mainly through giant multipole resonances. It is shown that the compound process dominates in the lower energy region especially for E1 capture whereas in the higher energy region direct and semidirect captures are the major processes especially for E2 capture. Several interesting results are obtained on α-particle spectroscopic factors of target ground states and on spreading widths and isospin-mixing coefficients of the giant multipole resonance states. The data are shown to be consistent with the existence of the isoscalar giant quadrupole resonances. The applicability of direct and semidirect capture theories to α-capture is examined. (NL)

15955 VECTOR ANALYZING POWER AND CROSS SECTION FOR THE REACTIONS ^{40}Ar(d(pol),p)^{41}Ar AND ^{40}Ar(d(pol),t)^{39}Ar. Sen, S.; Darden, S. E.; Yoh, W. A.; Berners, E. D. (Notre Dame Univ., Ind. (USA). Dept. of Physics). Nucl. Phys., A; 250: No. 1, 45-72(29 Sep 1975).

Angular distributions of vector analyzing power and cross section for the reactions ^{40}Ar(d,p)^{41}Ar and ^{40}Ar(d,t)^{39}Ar have been measured at an incident deuteron energy of 14.83 MeV. The bound-state data in the (d,p) reaction and the (d,t) data are compared to DWBA calculations. The data for the neutron-unbound states are analyzed in the framework of the DWBA using (i) a form factor for weakly bound neutron and (ii) a resonance form factor, following the approach of Vincent and Fortune. The j-dependence of the (d,p) vector analyzing power permits definite spin-parity assignments to be made for 19 neutron-bound and 4 neutron unbound states in ^{41}Ar with excitation energy up to 6.57 MeV. Tentative J^π assignments have been made for 3 states. The l-value for the 5.62 MeV states has been determined. Data for the observed unbound states are found to be equally well reproduced by the type (i) calculations as by the type (ii) calculations. The (d,t) vector analyzing power data show definite J-dependence although not as strongly as in the (d,p) reaction. For relatively weakly excited states a pre-knowledge of the l-value of the transition is desirable for an unambiguous spin assignment. In general, the J-dependence in the (d,t) vector analyzing power can be utilized for definite J^π assignments. On this basis, J^π values have been assigned for seven states in ^{39}Ar with excitation energies up to 4.47 MeV excitation. Possible spin values for three other states are suggested. Spectroscopic factors of the states in ^{41}Ar and ^{39}Ar have been extracted and are in fair agreement with those obtained by other workers. (NL)

15956 NEW STUDY OF THE ^{27}Al NUCLEUS THROUGH THE REACTION ^{26}Mg(d,n)^{27}Al. Uzureau, J. (Nantes Univ., 44 (France)). Nucl. Phys., A; 250: No. 1, 163-181(29 Sep 1975). (In French).

The ^{26}Mg(d,n)^{27}Al reaction has been studied at 6 and 8 MeV deuteron bombarding energies using the time-of-flight technique for neutron detection. The good neutron energy resolution of the present work permitted the determination of the excitation energy of 70 states populated by the reaction. Angular distributions of neutrons leading to 50 levels in ^{27}Al were measured between 0° and 100°. The experimental cross sections were analyzed in the framework of the DWBA and Hauser-Feshbach theories to deduce l_p values and transition strengths. New spin and parity assignments were obtained for 11 levels. The agreement between the DWBA predictions and some of the measured angular distributions was improved by modifying theoretical-model radii in both incoming and outgoing channels. The experimental results are compared with the corresponding data from previous studies and with Nilsson-model and recent shell-model calculations. (NL)

15957 THE ^{38}Ar(p,d)^{37}Ar REACTION. Parker, P. D.; Howard, A. J. (Yale Univ., New Haven, Conn. (USA). Nuclear Structure Lab.); Goosman, D. R. (Brookhaven National Lab., Upton, N. Y. (USA)). Nucl. Phys., A; 250: No. 2, 309-321(6 Oct 1975).

The ^{38}Ar(p,d)^{37}Ar reaction has been used to study the properties of the high-lying positive parity states in ^{37}Ar. Angular distributions in the region theta/sub cm/ equals 16 to 132^0 have been analyzed using the DWBA code DWUCK to determine the spectroscopic properties of these states. The two lowest T equals $\frac{3}{2}$ states have been identified at 4.98 MeV ($\frac{1}{2}^+$) and 6.65 MeV ($\frac{1}{2}^+$). The results are compared to recent shell-model calculations; their significance for the solar neutrino experiment is also discussed. (NL)

15958 TOTAL YIELD MEASUREMENTS IN ^{31}P(p,gamma)^{32}S. Brien, R. O.; Switkowski, Z. E.; Smith, A. K.; Sargood, D. G. (Univ., Melbourne). Aust. J. Phys.; 28: 155-162(1975).

The reaction ^{31}P(p,gamma)^{32}S has been investigated in the proton energy range 0.33-1.75 MeV. Total gamma-ray strengths were determined for 28 resonances. Yield curves were measured over limited portions of the energy range, which between them covered the whole range. An estimate of the nonresonant cross section was obtained, and total resonance widths were deduced. (auth)

15959 COMMENTS ON "THE (^{3}He,d) REACTION ON ^{28}Si." Coker, W. R. (Texas Univ., Austin (USA). Center for Nuclear Studies). Z. Phys., A; 273: No. 3, 251-252(Jul 1975).

2 tabs.; 14 refs.

An assertion made in a recent paper dealing with the ^{28}Si(^{3}He,d) reaction to the $\frac{1}{2}^+$ ground state of ^{29}P, namely that the spectroscopic factor extracted in the conventional way using DWBA analyses has a strong energy dependence, is shown to be due to a complication of inconsistent DWBA analyses by various authors, rather than being due to any intrinsic feature of the ^{28}Si(^{3}He,d) reaction mechanism. (DE)

Nuclear Properties and Reactions, 39 ≤ A ≤ 58

Refer also to abstracts 15421, 15725, 15930, 15940, 15946, and 16023.

15960 (CEA-N-1466(Pt.3)) CROSS-SECTIONS OF NUCLEAR REACTIONS INDUCED BY PROTONS, DEUTERONS AND α PARTICLES. III. Iron. Tobailem, J.; de Lassus St-Genies, C. H. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Service d'Electronique Physique). Jun 1975. 243p. (In French). INIS.

Cross sections are reviewed for nuclear reactions induced by protons, deuterons, and α particles on iron targets. When necessary, published experimental data are corrected, and, when possible, excitation functions are proposed. (FR)

15961 (CEA-N-1791, pp 220-222) MEASUREMENT OF THE DISTRIBUTION OF CHARGES, MASSES AND ENERGIES FOR

THE NUCLEI PRODUCED IN $^{40}Ar + ^{58}Ni$, $^{40}Ar + ^{64}Ni$, $^{40}Ca + ^{58}Ni$ AND $^{40}Ca + ^{64}Ni$ REACTIONS. Cauvin, B.; Girard, J.; Nifenecker, H. [nd]. (In French)

In Department of Nuclear Physics. Progress report, 1 October 1973–30 September 1974. (CEA Centre d'Etudes Nucleaires de Saclay, 91–Gif-sur-Yvette (France). Dept. de Physique Nucleaire).

Mass and charge of the products of the reactions $^{40}Ar + ^{58}Ni$, $^{40}Ar + ^{64}Ni$, $^{40}Ca + ^{58}Ni$, $^{40}Ca + ^{64}Ni$ were determined up to Z = 20 and M = 40. The results indicate that the charge equilibration (isospin) mode is completely damped in the multinucleon transfer process. (FR)

15962 (INIS-mf-1859) INELASTIC ELECTRON SCATTERING FROM ^{52}Cr AND ^{54}Fe. de Bie, J. E. P. (Amsterdam Univ. (Netherlands)). 21 May 1975. 98p. INIS.

Thesis.

The nuclei of ^{52}Cr and ^{54}Fe were subjected to inelastic electron scattering experiments with electrons of energy between 30 and 88 MeV. Analysis of the form factor results of the L = 2, L = 3 and L = 4 transitions in these even-even nuclei in terms of the Tassie- and Gauss-models was performed in DWBA, and yielded accurate values for reduced transition probabilities and for transition radii. The L = 0, L = 2, L = 3 and L = 4 form factor data of transitions in Cr 52 were also studied in terms of the harmonic vibrator model. Assuming that the first excited 2^+ state is a pure one-phonon quadrupole state, the experimental form-factors for the weak 2^+(2.96 MeV) and 0^+(2.65 MeV) transitions agree with the model predicted for two-phonon transitions. The 4^+ two-phonon transition could not be reproduced. The 2_1^+ state at 1.43 MeV and the 2_2^+ state at 3.16 MeV also were analyzed with the anharmonic–vibrator model; no agreement between theory and experiment could be obtained. On the other hand, the form factor of the 3.77 MeV (2^+) transition could be reproduced under certain assumptions. The form factor results of L = 2 and L = 4 transitions in Cr 52 and Fe 54 were analyzed in terms of the nuclear shell model. A fit with the lf → lf transition charge density to the L = 2 form factor data resulted in reasonable values for the harmonic-oscillator size parameter, whereas the values derived from the fits with the lf → 2p form factor were too small; except in case of the 3.77 MeV in Cr 52, which showed the expected form. (auth)

15963 (INR-1475/1/PL/B) INVESTIGATION OF THE COMPOUND NUCLEUS MECHANISM IN NUCLEAR REACTIONS INDUCED BY FAST NEUTRONS. Marcinkowski, A. (Institute of Nuclear Research, Warsaw (Poland)). 1973. 148p. (In Polish). INIS.

The excitation functions for (n,2n) (n,n') and (n,p) reaction were measured for target nuclei in the mass number range $40 \leq A \leq 204$. The experimental results were compared with the predictions of the statistical theory. Use was made of modified nuclear level density formulas based on the superconductivity theory. The γ decay of unbound states was included in the statistical calculations. The pre-equilibrium particle emission was found to be important at neutron energies surpassing 10 MeV. (auth)

15964 QUADRUPOLE MOMENTS AND THE STRUCTURE OF THE EVEN TITANIUM AND CHROMIUM NUCLEI. Towsley, C. W.; Cline, D.; Horoshko, R. N. (Rochester Univ., N. Y. (USA). Nuclear Structure Research Lab.). Nucl. Phys., A; 250: No. 2, 381-404(6 Oct 1975).

The static quadrupole moments of the lowest 2^+ states in $^{46,50}Ti$ and $^{50,52,54}Cr$ were measured to be -21 ± 6, 8 ± 16, -36 ± 7, -14 ± 8, and -21 ± 8 e·fm^2 respectively. Values for B(E2; $0_1^+ \rightarrow 2_1^+$) of 855 ± 40, 315 ± 30, 1020 ± 40, 660 ± 30, and 850 ± 30 e^2·fm^4 were measured for $^{46,50}Ti$ and $^{50,52,54}Cr$ respectively. Shell-model calculations for these and other $f_{7/2}$ shell nuclei were compared to the data. The N = 26, 28 nuclei are adequately described by the shell model if one-particle excitation into the $p_{\frac{1}{2}}$ and $f_{\frac{5}{2}}$ shells is allowed, but the other nuclei appear to have a more complicated structure. The coexistence model which has been applied to the calcium isotopes is in qualitative agreement with the present results and the assumption that the deformed band moves to a higher excitation energy as N → 28. (NL)

15965 SMALL-ANGLE SCATTERING OF 7 TO 14 MeV NEUTRONS BY NUCLEI. Bucher, W.; Hollandsworth, C. E. (U. S. Army Ballistic Research Laboratories, Aberdeen Proving Ground, Maryland 21005, USA). Phys. Lett., B; 58: No. 3, 277-278(15 Sep 1975).

Absolute differential cross sections for the small-angle elastic scattering of 7.55, 11.0, and 14.0 MeV neutrons by Fe, Cu, Ni, Sn, Pb, and Bi have been accurately determined by a method especially developed for the measurement of small-angle scattering. No evidence of anomalous scattering was observed. (NL)

15966 SPLITTING OF THE LOWEST T = 2 STATES IN ^{44}Ti, ^{48}Cr, AND ^{52}Fe. Moalem, A.; Shabuddin, M. A. M.; Markham, R. G.; Nann, H. (Michigan State Univ., East Lansing (USA). Cyclotron Lab.). Phys. Lett., B; 58: No. 3, 286-288(15 Sep 1975).

A high-resolution study of the ^{46}Ti, ^{50}Cr, $^{54}Fe(p,t)^{44}Ti$, ^{48}Cr, ^{52}Fe reactions provides evidence for the splitting of the lowest double analog states in ^{44}Ti and ^{48}Cr. The splitting is 20 ± 2 keV in ^{44}Ti and 10 ± 2 keV in ^{48}Cr. Splitting of the T = 2 state in ^{52}Fe could not be identified. Together with the previously observed splitting in ^{56}Ni the present results suggest that splitting is a common occurrence for self-conjugate nuclei in the $f_{\frac{7}{2}}$ shell. (NL)

15967 ELASTIC AND INELASTIC SCATTERING OF 15 MeV POLARIZED DEUTERONS FROM ISOTOPES OF Ca, Cu,Sr, Zr, AND Mo. Baker, F. T.; Davis, S.; Glashausser, C.; Robbins, A. B. (Rutgers–the State Univ., New Brunswick, N. J. (USA). Dept. of Physics). Nucl. Phys. A; 250: No. 1, 79-92(29 Sep 1975).

The elastic and inelastic scattering of 15 MeV polarized deuterons from ^{48}Ca, ^{63}Cu, ^{88}Sr, ^{90}Zr, ^{92}Zr, and ^{92}Mo has been investigated. Angular distributions of the cross section and vector analyzing power iT_{11} have been measured for all these nuclei; the tensor analyzing powers T_{20} and T_{22} have been studied for ^{92}Zr. Cross sections and vector analyzing powers are generally well explained by the optical model for elastic scattering and by the DWBA with a macroscopic form factor for the inelastic scattering; this is consistent with previous work. Distributions for ^{48}Ca, however, are poorly fitted. Anomalous behavior for the N = 50 nuclei found in the inelastic scattering of polarized protons is not present for deuterons. Tensor analyzing powers are not well explained by standard procedures; use of approximation folding model optical parameters did not improve the fits. The distribution of iT_{11} for the $\frac{1}{2}^-$ state in ^{63}Cu is significantly different from the distributions for the $\frac{5}{2}^-$ and $\frac{7}{2}^-$ states. (NL)

15968 GAMMA-RAY PRODUCTION CROSS SECTIONS FOR IRON FROM 0.86 TO 16.7 MeV. Orphan, V. J.; Hoot, C. G.; Rogers, V. C. (IRT Corp., San Diego, CA). Nucl. Sci. Eng.; 57: No. 4, 309-327(Aug 1975).

Gamma-ray production cross sections were measured for (n, xgamma) reactions in natural iron from 0.86- to 16.74-MeV neutron energy using the IRT Linac pulsed-neutron source. The 847- and 1238-keV gamma-ray production cross sections are presented with very high neutron resolution. Also, cross sections for 13 principal gamma rays are given using 20 neutron-energy groups. Cross sections were determined for an additional 16 discrete gamma rays using 10 neutron-energy groups. In general, the cross sections for the discrete gamma rays are in agreement with previous measurements. The gamma-ray spectra for the 10 neutron-energy groups were also unfolded to obtain gamma-ray production cross sections for the sum of both discrete and continuum gamma rays. The continuum component constituted over half the total gamma-ray production cross sections above 8 MeV. (12 figures, 5 tables) (auth)

15969 THE K-FLUORESCENCE YIELD OF TITANIUM AND THE DECAY OF ^{48}VANADIUM. Albrecht, G.; Hammer, J. W. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Strahlenphysik). Z. Phys., A; 273: No. 4, 405-410(1975). (In German).

3 figs.; 3 tabs.; 28 refs.

The K-fluorescence yield ω_K of titanium has been measured using the coincidence method and investigating the electron capture decay of ^{48}V. The detectors used have been a Si(Li)- and a Ge(Li)-detector for the X- and γ-rays. The experimental results are $P_K\omega_K = 0.2005 \pm 0.0030$ and $\omega_K(Ti) = 0.224 \pm 0.003$ using $P_K = 0.896$. For the branching ratios of the decay of ^{48}V we obtained EC (3.239) 7.9 ± 0.6%, EC (3.224) 2.9 ± 0.4%, EC (2.295) 35.6 ± 2.0%, β^+ (2.295) 52 ± 1.0%, all others 1.6%. Additionally some γ-ray-energies of the decay of ^{48}V and the half-life, $T_{\frac{1}{2}} = (16.23 \pm 0.03)$d, have been measured. (DE)

15970 ENERGY DEPENDENCE OF PROTON POLARIZATION IN ELASTIC SCATTERING AT SOME NUCLEI WITH A OF 50-62. Alekseev, N. V.; Ignat'ev, S. B.; Gulanov, I. R.; Romanovskii, E. A.; Tyurikov, G. S.; Zazulin, V. S.; Niyakli, S. F. (Lomonosov Univ., Moscow). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 3, 95-97(1975).

From 25th all-union conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1975). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 3, 574-577(1975).

In the elastic scattering of polarized protons of $E_p = 5–7$ MeV off nuclei with A = 40–62, considerable fluctuations have been observed in the energy dependence of the polarization. To examine this effect, the energy dependence of the polarization in elastic proton scattering was measured for $^{50,52,54}Cr$, ^{59}Co, and $^{58-62}Ni$. Results are discussed in terms of the statistical model. (SDF)

15971 REACTION $^{40}Ar(p, n)$ TO THE ANTIANALOG STATE IN ^{40}K. Galonsky, A.; Branson, J.G.; Doering, R.R.; Patterson, D.M. (Cyclotron Laboratory, Department of Physics, Michigan State University, East Lansing, Michigan 48824). Phys. Rev. Lett. 35: No. 18, 1208-1211 (3 Nov 1975).

We have measured $^{40}Ar(p,n)^{40}K$(antianalog) differential cross sections at 24 MeV and made microscopic distorted-wave Born-approximation calculations for these cross sections. Unlike the (^{3}He,t) reaction to the same state, where it is necessary to invoke a two-step mechanism, the (p,n) data are fitted by the one-step calculation. A one-step calculation also fits $^{40}Ar(p,n)^{40}K$(isobaric analog) data with the same nucleon-nucleon interaction used in the antianalog-state calculation. (auth)

15972 ABSOLUTE CROSS SECTIONS FOR PRODUCTION OF PROMPT NUCLEAR γ RAYS BY FAST PIONS. Jackson, H.E.; Kovar, D.G.; Meyer-Schutzmeister, L.; Vigdor, S.E.; Wangler, T.P.; Segel, R.E.; Schiffer, J.P.; Burman, R.L.; Gram, P.A.M.; Drake, D.M.; Lind, V.G.; Hatch, E.N.; Otteson, O.H.; McAdams, R.E.; Cook, B.C.; Clark, R.B. (Argonne National Laboratory, Argonne, Illinois 60439). Phys. Rev. Lett. 35: No. 17, 1170-1172 (27 Oct 1975).

Cross sections have been measured for the production of prompt nuclear γ rays in the pion bombardment of Al, Ca, V, and ^{60}Ni. Several disagreements with values in the literature are noted. (auth)

15973 SYSTEMATICS OF GROUND-STATE α-PARTICLE SPECTROSCOPIC STRENGTHS FOR *sd*- AND *fp*-SHELL NUCLEI. Anantaraman, N.; Bennett, C.L.; Draayer, J.P.; Fulbright, H.W.; Gove, H.E.; Tōke, J. (Nuclear Structure Research Laboratory, University of Rochester, Rochester, New York 14627). Phys. Rev. Lett. 35: No. 17, 1131-1134 (27 Oct 1975).

We present systematics of the ground-state α-particle spectroscopic strengths for nuclei from ^{20}Ne to ^{66}Zn, measured in the (^{6}Li,d) reaction. An oscillatory decrease from ^{20}Ne to ^{32}S, which is in excellent agreement with SU(3) theory, is followed by a striking and unexplained increase at ^{36}Ar and ^{40}Ca and than a decrease up to ^{52}Ti, after which there is again a rise. (auth)

Nuclear Properties and Reactions, 59 ≤ A ≤ 89

Refer also to abstracts 15421, 15641, 15719, 15930, 15941, 15963, 15965, 15967, 15970, 15972–15974, and 16023.

15974 (JINR-E6-9133) EXCITED STATES OF ^{85}Sr. Liptak, J.; Beyer, G.; Gromov, K. J.; Fominikh, V. I.; Novgorodov, A. F.; Kristiakova, K.; Habenicht, W. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 27p. Dep. NTIS (US Sales Only) $5.00.

High resolution γ-ray studies have shown the decay patterns of isomers of ^{85}Y to be more complex. The level scheme of ^{85}Sr is proposed from the results of γ-γ coincidence measurements. Spin and parity assignments to the levels of ^{85}Sr were made on the basis of log ft values, nuclear reaction data and γ-ray branchings. The level scheme is discussed in the framework of the theoretical calculation of $n(g_{\frac{9}{2}})^{-3}$ cluster properties. (3 tables, 5 figures) (auth)

15975 CHANNEL–CHANNEL CROSS-CORRELATIONS BETWEEN THE CROSS SECTIONS IN THE REACTIONS $^{88}Sr(p,p_0)$ AND $^{88}Sr(p,p_1)$ NEAR A $2d_{\frac{5}{2}}$ ISOBARIC ANALOGUE RESONANCE IN ^{89}Y. Blanke, E.; Genz, H.; Richter, A.; Schrieder, G. (Bochum Univ. (F. R. Germany). Inst. fuer Experimentalphysik). Phys. Lett., B; 58: No. 3, 289-292(15 Sep 1975).

Fine-structure measurements of the differential cross section in elastic and inelastic proton scattering at E_p approximately 7.5 MeV from ^{88}Sr near a $2d_{\frac{5}{2}}$ isobaric analogue resonance in ^{89}Y exhibit strong correlations between the cross section fluctuations in the two different channels. (NL)

15976 DECAY OF ^{85}Br. Nuh, F. M.; Slaughter, D. R.; Prussin, S. G. (California Univ., Berkeley (USA). Dept. of Nuclear Engineering). Nucl. Phys., A; 250: No. 1, 1-12(29 Sep 1975).

γ-ray transitions following β^--decay of ^{85}Br have been identified through analysis of the γ-ray spectrum of fission product bromine isotopes. Of the forty-four transitions identified, twenty-six have been incorporated in a level scheme which includes the majority of levels observed in the reaction $^{82}Se(\alpha,n\gamma)^{85}Kr$ and a number of levels not previously defined. The proposed scheme is compared with ^{85}Kr levels observed in neutron stripping and pickup reactions. (NL)

15977 γ-RAY EMISSION FROM $^{80-86}$As ISOTOPES. Kratz, J. V.; Franz, H.; Kaffrell, N.; Hermann, G. (Mainz Univ. (F. R. Germany). Inst. fuer Anorganische Chemie und Kernchemie). Nucl. Phys., A; 250: No. 1, 13-37(29 Sep 1975).

Activities of $^{80-86}$As were produced in (n,p) reactions on stable selenium nuclei as fission products, and via β-decay from their precursors. To separate arsenic and germanium from fission product mixtures, rapid chemical separations were applied. γ-ray emission from arsenic isotopes was studied in γ-singles and $\gamma\gamma$ coincidence experiments. Partial decay schemes are proposed for 34 sec ^{81}As, 14.0 sec and 19.1 sec ^{82}As, 13.3 sec ^{83}As and 5.3 sec ^{84}As. The delayed-neutron branch in the decay of 2.05 sec ^{85}As was shown to preferentially populate several excited levels in ^{84}Se while the ground state of ^{84}Se is fed to 29% only. The systematics of low-lying levels in doubly even selenium isotopes is extended up to mass number 86. Discontinuities in the systematics at N = 48 are interpreted as an indication of a soft character of the nucleus ^{82}Se. (NL)

15978 YRAST CASCADE IN ^{60}Ni. Kim, H. J.; Ballini, R., Delaunay, B.; Delaunay, J.; Fouan, J. P.; Pichevar, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 – Gif-sur-Yvette (France). Dept. de Physique Nucleaire). Nucl. Phys., A; 250: No. 1, 211-220(29 Sep 1975).

Yrast levels of ^{60}Ni were investigated via the study of in-beam γ-rays induced by 15-25 MeV α-particles on ^{58}Ni, 26-48 MeV ^{12}C ions on ^{50}Cr and 30-60 MeV ^{16}O ions on ^{46}Ti. The compound nucleus formed by these target-projectile combinations is ^{62}Zn, and its decay by two-proton emission populates yrast levels of ^{60}Ni. The ordering and decay modes of the yrast levels were determined from the analyses of in-beam γ-ray angular distribution and γ-γ coincidence measurements. The new levels established are at 4.262, 5.345, and 6.807 MeV. These together with the known 2_1^+(1.332 MeV) and 4_1^+(2.505 MeV) levels constitute the yrast cascade. The spin assignments based on the present study are 6, 7, 9 for the 4.262, 5.345, and 6.807 MeV levels, respectively. The excitation functions for the yrast γ-rays from the $^{50}Cr(^{12}C,2p)$ ^{60}Ni reaction show peaks near 33 MeV incident energy. (NL)

15979 NEUTRON-INDUCED GAMMA-RAY PRODUCTION IN ZINC FOR INCIDENT-NEUTRON ENERGIES OF 4.9, 5.4, AND 5.9 MeV. Dickens, J. K. (Oak Ridge National Lab., TN). Nucl. Sci. Eng.; 58: No. 3, 331-338(Nov 1975).

Interactions of neutrons with zinc have been studied by measuring gamma-ray-production cross sections. For a sample of natural zinc, spectra were obtained for incident-mean-neutron energies, E/sub n/ equals 4.9, 5.4, and 5.9 MeV with gamma-ray detector systems utilizing coaxial Ge(Li) detectors. Nearly monoenergetic neutrons were obtained from the D(d,n) reaction using deuterons obtained from the (pulsed) Oak Ridge National Laboratory 5-MV Van de Graaff accelerator. Time-of-flight was used to discriminate against pulses due to neutrons and background radiation. Gamma-ray identification was aided by obtaining spectra for samples enriched in the isotopes ^{64}Zn and ^{68}Zn, and new information on the level structure of ^{64}Zn is reported. These cross sections have been compared, where possible, with previous comparable measurements with generally satisfactory results. 2 figures, 3 tables. (auth)

15980 MEASUREMENT OF ^{61}Ni SPECTROSCOPIC FACTORS USING THE (d,p) REACTION IN SUB-COULOMBIAN REGIME. Baghadi, A. (Leningradskij Gosudarstvennyj Univ. (USSR)); Seltz, R.; Magnac-Valette, D.; Bonneaud, G.; Gerardin, C. (Centre National de la Recherche Scientifique, 67–Strasbourg (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France)). J. Phys. (Paris), Lett.; 36: No. 7, L.181-L.183(Jul 1975). (In French)

Spectroscopic factors for the two most strongly excited $l = 0$ and $l = 2$ states in ^{61}Ni have been measured via the (d,p) reaction in the sub coulombian regime. The results confirm that the sum rule for the filling of the $3s_{\frac{1}{2}}$ and 2d orbitals in ^{61}Ni is only obeyed up to 50%. (FR)

15981 THE LEVEL STRUCTURE OF ^{69}Ge. Eberth, U.; Eberth, J.; Eube, E.; Zobel, V. (Koeln Univ. (F. R. Germany). Inst. fuer Kernphysik). Z. Phys., A; 273: No. 4, 411-420(1975).

7 figs.; 2 tabs.; 15 refs.

The γ-ray decay of the states in ^{69}Ge has been studied using the reaction $^{66}Zn(\alpha,n\gamma)^{69}Ge$ at E_α = 13 and 19 MeV. The level scheme and spin assignments were established by means of coincidence measurements, angular distribution and excitation functions. 27 new levels could be found or confirmed. It is suggested that ^{69}Ge is a further example for the weak coupling phenomenon in the medium mass nuclei. (DE)

15982 SEPARATION OF COMPOUND AND DIRECT REACTION PROCESSES BY THE CRYSTAL BLOCKING TECHNIQUE. Kanter, E.P.; Hashimoto, Y.; Leuca, I.; Temmer, G.M.; Alvar, K.R. (Department of Physics, Rutgers University, New Brunswick, New Jersey 08903); Gibson, W.M. Phys. Rev. Lett. 35: No. 20, 1326-1328 (17 Nov 1975).

The crystal blocking effect was used to study the time distribution of 5-MeV protons elastically scattered from a germanium crystal. The time

delay associated with compound-elastic scattering is estimated and used to separate the direct and compound–nuclear contributions to the elastic cross section. (auth)

15983 FINAL-STATE SPIN DEPENDENCE FOR INELASTIC SCATTERING FROM ODD-*A* NUCLEI. Love, W.G.; Baker, F.T. (Department of Physics and Astronomy, The University of Georgia, Athens, Georgia 30602). Phys. Rev. Lett. 35: No. 18, 1219-1223 (3 Nov 1975).

The previously unexplained dependence of proton and deuteron inelastic scattering on the spin of the residual nucleus is shown, in an almost model-independent way, to result from scattering from the *ground-state* quadrupole moment. (auth)

15984 DECAY OF ^{77}Rb. Liptak, Ya.; Habernicht, W. (Joint Inst. of Nuclear Research, Dubna, USSR). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 3, 36-39(1975).

From 25th all-union conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1975). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 3, 501-505(1975).

A detailed investigation of the decay of ^{77}Rb is discussed and along with a study of the structure of the levels of the daughter even-odd nucleus ^{77}Kr. The ^{77}Rb was obtained in the reaction involving deep spallation of the nuclei in a Zr + Nb target. (auth)

Nuclear Properties and Reactions, 90 ≤ A ≤ 149

Refer also to abstracts 15641, 15941, 15946, 15963, 15965, 15967, 15989, 16023, and 16025.

15985 (INIS-mf-1763) ELASTIC AND INELASTIC ELECTRON SCATTERING FROM ^{142,146,150}Nd. Maas, R. (Amsterdam Univ. (Netherlands)). 16 Oct 1974. 89p. INIS.

Thesis.

15986 (INIS-mf-1843) ANNUAL REPORT 1974. (Tandemacceleratorlaboratoriet, Uppsala (Sweden)). Jan 1975. 88p. INIS.

About 85 percent of the beam time for research during 1974 was used for investigations in nuclear physics, covering a rather broad range of topics from research on the properties of few-particle systems and light nuclei, and, for instance, studies of the possibilities of coexistence of spherical and deformed states in medium-weight nuclei, to the measurements of cross sections for neutron-induced fission in heavy nuclei. Magnetic dipole and electric quadrupole nuclear moments were determined by the ion-implantation perturbed angular correlation and the reorientation precession techniques, respectively. Beam-foil spectroscopy was carried out with oxygen and fluorine beams. Accelerator beams have further been used for analyses of surface composition and for nitrogen (protein) determination in seeds. The method for elemental analysis through particle-induced x-rays was studied and combined with reaction techniques to make it useful for a wider range of elements. Details of these experiments are given, as well as information on the research instrumentation and data acquisition and handling systems. (auth)

15987 (ORO-1316-198) NUCLEAR STRUCTURE AT INTERMEDIATE ENERGIES. Progress Report, April 1, 1975-March 31, 1976. Phillips, G. C. (Rice Univ., Houston, Tex. (USA). Bonner Nuclear Labs.). 1975. Contract E(40-1)-1316. 28p. Dep. NTIS $4.00.

Experimental research on nuclear structure from the study of strong interactions at intermediate energies is summarized. A list of publications is included. (JFP)

For abstracts of individual sections see: 15588, 16014, 16025, 16026, and 16369.

15988 (ORO-3346-173) NUCLEAR AND X-RAY SPECTROSCOPY WITH RADIOACTIVE SOURCES. Eleventh Annual Progress Report, February 1, 1975–January 31, 1976. Fink, R. W. (Georgia Inst. of Tech., Atlanta (USA). School of Chemistry). 31 Oct 1975. Contract AT(40-1)-3346. 38p. Dep. NTIS $5.00.

Separate abstracts have been prepared for five sections of the report. (SDF)

15989 SUB-NANOSECOND LIFETIMES IN ^{126}Te. Bargholtz, C.; Becker, J.; Fransson, K.; Holmberg, L. (Stockholm Univ. (Sweden). Fysiska Institutionen). Nucl. Phys., A; 250: No. 2, 227-234(6 Oct 1975).

The half-lives of the 1776.8 keV 6^+ level and the 2497.3 keV 7- level in ^{126}Te are measured by registering β-γ coincidence in the decay of ^{126}Sb. The results are $T_{\frac{1}{2}}(1776.8) = 66 \pm 3$ ps and $T_{\frac{1}{2}}(2497{=}3) = 152 \pm 5$ ps. The collective strength of the $6^+ \rightarrow 4^+$ transition depopulating the 1776.8 keV state is estimated. An additional half-life of 0.36 ± 0.06 ns is found but not definitely assigned in the level scheme. (NL)

15990 THE ^{100}Mo(p,n)^{100}Tc REACTION CROSS SECTION AND ITS USE AS A NORMALIZATION FOR SHUTTLE-SYSTEM MEASUREMENTS. Kneff, D. W.; Mann, F. M.; Switkoski, Z. E. (California Inst. of Tech., Pasadena (USA)). Nucl. Phys., A; 250: No. 2, 285-294(6 Oct 1975).

The ^{100}Mo(p,n)^{100}Tc reaction cross section was determined from 2 to 11 MeV (c.m.), by counting the delayed γ-rays from the ^{100}Tc decays (half-life = 15.8 s). These yields were measured with Ge(Li) and NaI(Tl) detectors and thick natural Mo targets. The use of this reaction as a normalizing reaction for cross-section measurements with a rapid target-transfer system is discussed. This technique was applied to the measurement of the astrophysically interesting ^{23}Na(p,n)^{23}Mg cross section (^{23}Mg half-life = 11.57 s). The results agree well with an independent ^{23}Na(p,n)^{23}Mg cross-section measurement. (NL)

15991 STATIC QUADRUPOLE MOMENTS OF THE 2_1^+ STATES IN ^{126}Te AND ^{128}Te. Ragland, T. V.; Mitchell, R. J.; Scharenberg, R. P. (Purdue Univ., Lafayette, Ind. (USA). Dept. of Physics). Nucl. Phys., A; 250: No. 2, 333-340(6 Oct 1975).

The reorientation effect in Coulomb excitation was used to measure the static quadrupole moments of the first 2^+ states in ^{126}Te and ^{128}Te. The particle-γ coincidence technique using a large NaI(Tl) crystal was employed to measure relative excitation probabilities at backward and forward projectile scattering angles. The Winther-de Boer multiple Coulomb excitation program was used to analyze the data. The influence of the deorientation effect was also determined. For positive interference via the second 2^+ state the extracted quadrupole moments of the first 2^+ states are; -0.20 ± -0.09 b and -0.24 ± -0.08 b for ^{126}Te and ^{128}Te respectively. The quadrupole moments of the first 2^+ states of ^{122,124,126,128,130}Te determined by different techniques are in excellent agreement with one another. The values are compared with recent theoretical calculations. (NL)

15992 EFFECT OF NUCLEAR DEFORMATION ON NEUTRON ELASTIC SCATTERING. Lagrange, C.; Shamu, R. E. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 – Montrouge (France)); Burrows, T.; Glasgow, G. P. (Kentucky Univ., Lexington (USA)); Hardie, G. (Western Michigan Univ., Kalamazoo (USA)); McDaniel, F. D. (North Texas State Univ., Denton (USA)). Phys. Lett., B; 58: No. 3, 293-296(15 Sep 1975).

The scattering of neutrons from ^{148}Sm and ^{154}Sm has been studied at 6.25 MeV. Evidence is presented that the main effect of nuclear deformation on neutron elastic scattering is to decrease appreciably the scattering at back angles. (NL)

15993 PROTON–NEUTRON INTERACTION IN ^{98}Nb WITH THE (τ,p) REACTION. Medsker, L. R.; Fortune, H. T. (Pennsylvania Univ., Philadelphia (USA). Dept. of Physics). Phys. Lett., B; 58: No. 3, 297-299(15 Sep 1975).

States of ^{98}Nb observed in the ^{96}Zr(τ,p)^{98}Nb reaction can be interpreted in terms of $1g_{\frac{9}{2}}$ and $2p_{\frac{1}{2}}$ protons coupled with $1g_{\frac{9}{2}}$, $3s_{\frac{1}{2}}$, and $2d_{\frac{5}{2}}$ neutrons. The ground-state angular distribution is consistent with $J^\pi = 1^+$, probably arising from $\pi g_{\frac{9}{2}} \nu g_{\frac{9}{2}}$. The 1^+ and the $\pi g_{\frac{9}{2}} \nu s_{\frac{1}{2}} 5^+$, 84 keV excited states are interpreted as the 2.8 s and 51.5 min isomers, respectively, in ^{98}Nb. The measured g.s. Q-value reduces by a factor of 10 the uncertainty in the ^{98}Nb mass. (NL)

15994 NUCLEAR ORIENTATION OF NEGATIVE PARITY STATES OF ^{131}Xe. Koene, B. K. S.; Postma, H.; Ligthart, H. (Rijksuniversiteit Groningen (Netherlands)). Nucl. Phys., A; 250: No. 1, 38-44(29 Sep 1975).

The anisotropies of the 177, 326, and 503 keV γ-transitions between negative parity states of ^{131}Xe have been remeasured in the decay of oriented ^{131}I nuclei. In addition the linear polarization of the 503 keV radiation has been determined with a Compton polarimeter consisting of two Ge(Li) detectors. A combined analysis of the reported experiment and earlier internal conversion and angular distribution data yields the unique assignments $\frac{9}{2}^-$ and $\frac{7}{2}^-$ for the levels at 341 and 667 keV. The E2/M1 mixing ratios of the 177 and 326 keV transitions are $\delta(177) = -4.5 \pm 1.5$ and $\delta(326) = -4.4 \pm 1.6$. The intensity of the L = 2 component in the first forbidden β-decay of the 667 keV level is at most 60%. (NL)

15995 ABSOLUTE TRANSITION PROBABILITIES IN ^{134}Ba. Burde, J.; Eshhar, S.; Ginsburg, A.; Molchadzki, A. (Hebrew Univ., Jerusalem (Israel). Racah Inst. of Physics). Nucl. Phys., A; 250: No. 1, 141-148(29 Sep 1975).

Lifetime measurements of the excited states of ^{134}Ba were carried out by delayed coincidence measurements between the β-spectrum of ^{134}Cs and the conversion lines and γ-transitions that de-excite the levels, using double-lens coincidence and β-γ

coincidence spectrometers. The mean lifetimes of the 1400 keV and 1643 keV levels were determined to be $\tau = 12.5 \pm 2.5$ psec and 113 ± 30 psec, respectively. The ratio of the reduced transition probabilities $B(E2; 4^+ \rightarrow 2^+)/B(E2; 2^+ \rightarrow 0^+) = 0.15 \pm 0.03$. This result does not agree with prediction of the rotational or vibrational model, although the energy spacings, spin sequence and relative intensities of the de-exciting transitions for the first four excited states could be accounted for by the symmetric rotational model. The results indicate that the reduction in collectivity as experienced by the 4^+ member of the quasi-rotational band, due to an apparent change in the structure of the nucleus, is reflected also in the 3^+ member of the γ-vibrational band which is situated nearby in energy. (NL)

15996 SHOCK WAVES AND MACH CONES IN FAST NUCLEUS-NUCLEUS COLLISIONS. Baumgardt, H. G.; Schott, J. U.; Sakamoto, Y.; Schopper, E. (Frankfurt Univ. (F. R. Germany). Inst. fuer Kernphysik); Stoecker, H.; Hofmann, J.; Scheid, W.; Greiner, W. (Frankfurt Univ. (F. R. Germany). Inst. fuer Theoretische Physik). Z. Phys., A; 273: No. 4, 359-371(1975).

14 figs.; 2 tabs.; 21 refs.

Mach shock waves and head shock waves occur during the interpenetration of a light high energetic nucleus with a heavy one. Collisions of ^{16}O, ^{12}C and ^4He ions at energies between 0.25 and 2.1 GeV/N with Ag and Cl nuclei have been investigated. The theoretical concepts and the experiment are presented and interpreted. From that a velocity of first sound in nuclear matter c_s approximately 0.19c, a Mach shock velocity v_s approximately 0.58c and a nuclear compression constant K = 300 MeV are deduced. (DE)

15997 THE DECAY OF 18.2 m ^{104}Tc. Tivin, P. J.; Schulte, R. L.; Taylor, H. W. (Toronto Univ., Ontario (Canada). Dept. of Physics). Z. Phys., A; 273: No. 4, 339-347(1975).

4 figs.; 2 tabs.; 14 refs.

^{104}Tc was produced through the $^{104}Ru(n,p)^{104}Tc$ reaction using target material enriched to 99.7% in ^{104}Ru. The energies and intensities of the γ-rays emitted by ^{104}Tc were measured with a multichannel Ge(Li) spectrometer. A revised level scheme is proposed which contains 33 levels and incorporates 85 γ-ray transitions. The half life of ^{104}Tc was observed to be 18.2 ± 0.5 min. (DE)

15998 HIGH SPIN STATES IN ^{95}Te POPULATED IN THE $^{93}Nb(\alpha,2n\gamma)$ REACTION. Hippe, D.; Heits, B.; Schuh, H. W.; Zell, K. O.; Friederichs, H. G.; Brentano, P. von (Koeln Univ. (F. R. Germany). Inst. fuer Kernphysik). Z. Phys., A; 273: No. 4, 349-357(1975).

8 figs.; 4 tabs.; 16 refs.

The $^{93}Nb(\alpha,2n\gamma)^{95}Tc$ reaction has been studied at a bombarding energy of 22.5 MeV using Ge(Li)-detectors. Gamma singles spectra, gamma-gamma coincidences, excitation functions and gamma angular distribution have been obtained. A level scheme has been constructed. Spin and parity assignments up to $^{29}/_2^+$ are given. (DE)

15999 LEVELS OF ^{142}Pr POPULATED BY $(\alpha,n\gamma)$ AND $(p,n\gamma)$ REACTIONS AND DETERMINATIONS OF MATRIX ELEMENTS OF THE EFFECTIVE RESIDUAL INTERACTION AMONG PROTON AND NEUTRON. Bercks, C.; Hummel, E.; Schedl, K. H. (Erlangen-Nuernberg Univ., Erlangen (F. R. Germany). Physikalisches Inst.). Z. Phys., A; 273: No. 4, 385-391(1975). (In German)

5 figs.; 4 tabs.; 19 refs.

The structure of the odd-odd nucleus ^{142}Pr has been studied at the Erlangen Tandem Van de Graaff accelerator by using the nuclear reactions $^{139}La(\alpha,n\gamma)$ and $^{142}Ce(p,n\gamma)$. Neutron-gamma and gamma coincidence measurements have been performed. From a fit of experimentally determined γ-branching ratios to theoretical transition probabilities the amplitudes of the wavefunctions have been derived. From these wavefunctions and the energies of states and configurations in ^{141}Pr, matrix elements of the effective residual p,n-interaction have been obtained. (DE)

16000 THE DECAYS OF Rh^{97g} AND Rh^{97m}. Plueckebaum, W. (Goettingen Univ. (F. R. Germany). 2. Physikalisches Inst.). Z. Phys., A; 273: No. 4, 393-400(1975). (In German)

5 figs.; 2 tabs.; 16 refs.

The decays of Rh^{97g} and Rh^{97m} were investigated using Ge(Li)- and Si(Li)-detectors and a Ge(Li)-Ge(Li)-coincidence circuit. The isomeric transition with an energy of 259 keV was identified by its conversion electrons and decays with a half-life of (48.0 ± 0.8) min. Therefore, the half-lives (30.3 ± 0.9) min and (47.9 ± 0.6) min obtained from the γ-studies were attributed to the decays of Rh^{97g} and Rh^{97m} respectively. The proposed decay schemes have 31 excited states of Ru^{97} and account for 84 of the 110 observed γ-transitions, especially for the 37 strongest ones. Twelve of the proposed levels having spins and parities $^1/_2^-$ or $^3/_2^-$ and excitation energies between 2,200 keV and 3,600 keV are interpreted as being due to $2p_{^1/_2}$-neutron-hole-states. (DE)

16001 NUCLEAR STRUCTURE OF ^{115}In. Bosch, H. E.; Davidson, J.; Silberglelt, V.; Heras, C. A.; Abecasis, S. M. (Instituto de Investigacion Aeronautica Y Espacial, Buenos Aires (Argentina). Lab. de Radiaciones Y Alta Atmosfera; Buenos Aires Univ. Nacional (Argentina). Departamento de Fisica). Z. Phys., A; 273: No. 4, 373-380(1975).

5 figs.; 8 tabs.; 23 refs.

The character of the excited levels of ^{115}In was analyzed through the decay of ^{115g}Cd and ^{115m}Cd. Beta and gamma-ray spectra were recorded, and beta-gamma and gamma-gamma coincidences as well as gamma-gamma angular correlations were performed. Several semiconductor detectors have been used, such as Si(Li) and intrinsic germanium of different volumes and efficiencies. New results on the gamma (35)-gamma (232) angular correlation are presented, as well as confirmatory ones on the gamma (35)-gamma (493) and gamma (484)-gamma (934). Mixing ratios for all these cascades with the corresponding sign are established. The shape factor of the beta spectrum to the 1,291.2-keV level is determined for the first time, and a confirmatory value for the shape factor of the beta spectrum to the 934.4-keV level is obtained. Gamma-gamma coincidence experiments show that the 105.3-keV gamma ray follows the 485-keV transition. Theoretical calculations were made to fit the experimental results by using the generalized semimicroscopic model. State vectors for some even-parity states are presented well as theoretical branching and mixing ratios, and nuclear lifetime. (DE)

16002 DECAY OF ^{117}Cd. Sergienko, V. A.; Zarubin, P. P.; Vorontsovskii, A. M.; Padalko, V. Yu. (Leningrad State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 3, 136-141(1974).

From 25th all-union conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1975). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 3, 625-631(1975).

The γ-ray spectrum of ^{117}Cd has been examined; the results serve to refine the decay schemes for the two ^{117}Cd isomers. The relative yields of the isomers in $^{116}Cd(d,p)^{117}Cd$ have also been determined for deuteron energies of 6 and 12 MeV. (1 figure, 2 tables) (auth)

16003 INVESTIGATION OF RADIOACTIVE DECAY OF ^{149}Gd. Aleksandrov, V. S.; Vylov, Ts.; Gromova, I. I.; Klyuchnikov, A. A.; Novgorodov, A. F.; Feoktistov, A. I. (Joint Inst. for Nuclear Research, Dubna, USSR). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 3, 9-15(1975).

From 25th all-union conference on nuclear spectroscopy and nuclear structure; Leningrad, [illegible] Jan 1975). Translated from Izv. Akad. Nauk SSSR, [illegible] No. 3, 468-477(1975).

An investigation is made [illegible] d conversion-electron spectra using better sour[illegible]ic equipment, and procedures, for the purpo[illegible]ting and discussing a more complete decay scheme for [illegible] of ^{149}Gd. (6 figures, 3 tables) (auth)

16004 EQUILIBRIUM DEFORMATIONS OF NEUTRON-RICH NUCLEI IN THE BARIUM REGION. Ivanova, S. P.; Fedotov, S. I. (Joint Inst. for Nuclear Research, Dubna, USSR). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 3, 16-19(1975).

From 25th all-union conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1975). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 3, 478-481(1975).

A study is made of the properties of certain neutron-rich isotopes of xenon, barium, and cerium. The shape of the even-even isotopes of these nuclei in the ground state is considered by calculating the equilibrium values of β_{20}, β_{40}, Q_{20}, and Q_{40}. (2 figures, 2 tables) (auth)

16005 E2-TRANSITIONS OF ^{108}Pd WITHOUT CHANGE IN THE NUMBER OF PHONONS. Jolos, R. V.; Denau, F.; Janssen, D. (Joint Inst. of Nuclear Research, Dubna, USSR). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 3, 56-58(1975).

From 25th all-union conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1975). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 3, 532-534(1975).

The first experimental results on the study of E2-transitions between the levels of a "two-phonon" triplet has yielded the lower boundary of the ratio $B(E2; 4_1^+ \rightarrow 2_2^+)/B(E2; 4_1^+ \rightarrow 2_1^+) > 80$ for ^{108}Pd. This result characterizes strong forbiddenness for E2-transitions between the levels of the "two-phonon" triplet 2_2^+, 4_1^+. It is shown that it is very difficult to explain it and the simultaneously high value of the quadrupole moment of the 2_1^+-state

and the low value of $B(E2; 2_1^+ \rightarrow 0_1^+)/B(E2; 2_1^+ \rightarrow 0_1^+)$ while remaining within the framework of the model which takes account of only the mixing of components having a small number of phonons. (auth)

16006 MEASUREMENT OF THE ABSOLUTE INTENSITY OF γ-RAYS HAVING ENERGIES OF 511.8 AND 622 keV EMITTED BY ^{106}Rh. Geidel'man, A. M.; Ovechkin, V. V.; Rau, D. F.; Fedotov, P. I.; Khol'nov, Yu. V. Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 3, 76-79(1975).

From 25th all-union conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1975). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 3, 555-559(1975).

The intensity of the β-transition of ^{106}Rh to the ground state of ^{106}Pd is found to be less than 80% of the decays. In order to calculate the gamma-constant of ^{106}Rh, the absolute intensities of all known quanta of this nuclide were determined, using our value of the number of quanta per decay (k_γ) and the relative intensities of γ-rays. The results of calculations of K_γ for various ranges of γ-ray energies are tabulated. In the calculations, the errors in the values of the relative intensities of the γ-rays were taken to equal: 7% for the case $k_\gamma < 2.2 \cdot 10^{-2}$%; 12% for $0.22 \cdot 10^{-3} < k_\gamma < 2.2 \cdot 10^{-2}$%, and 50% for $k_\gamma < 0.22 \cdot 10^{-3}$%. (auth)

16007 GAMMA-RAY SPECTROSCOPY OF SHORT-LIVED FISSION PRODUCTS USING THE RECOIL SEPARATOR "LOHENGRIN." Bailleul, G.; Bocquet, J. P.; Schrader, H.; Stippler, R.; Pfeiffer, B.; Asghar, M.; Chauvin, C.; Gautheron, J. P.; Greif, J.; Siegert, G. (Institut Max von Laue-Paul Langevin, 38-Grenoble (France)). Z. Phys., A; 273: No. 3, 283-289(Jul 1975).

8 figs.; 6 tabs.; 19 refs. Part of a thesis by Bailleul, G.

γ-Spectra and half-lives of ^{90}Br, ^{95}Rb, ^{96}Rb, ^{96}Y, ^{132}Sb and ^{132}Sn have been measured using the unslowed fission fragment separator "Lohengrin." Preliminary decay schemes for ^{90}Kr, ^{95}Sr, ^{96}Sr and ^{96}Y are given. (DE)

16008 OCTUPOLE VIBRATIONS AND GROUND STATE CORRELATIONS. Hernandez, E. S. (Buenos Aires Univ. Nacional (Argentina). Departamento de Fisica); Plastino, A. (La Plata Univ. Nacional (Argentina). Departamento de Fisica). Z. Phys., A; 273: No. 3, 253-258(Jul 1975).

4 figs.; 3 tabs.; 16 refs.

The relationship between ground-state correlations and collectiveness is investigated for the case of low-lying nonrotational states in the rare earth nuclei. Both octupole and quadrupole modes of excitation are studied and the quasiparticle virtual populations associated with each of them are discussed. The relative importance of particle-particle and particle-hole interaction matrix elements is also analyzed in connection with the shape of the correlation patterns. The fundamental role of the Nilsson + BCS scheme is emphasized and the consistency of the quasiparticle random-phase approximation is established. (DE)

16009 DECAY OF 7.3 MIN ^{93}Sr. 1.7 SEC ISOMERIC STATE OF ^{93}Y. Schussler, F.; Cavallini, P.; Carraz, L. C.; Brissot, R.; Crancon, J.; Monnand, E.; Ristori, C.; Moussa, A. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale). Radiochim. Acta; 21: No. 1, 8-11(1974). (In French)

4 figs.; 2 tabs.; 6 refs.

A new ^{93}Y isomeric state ($T_{\frac{1}{2}}$ = 1.7 ± 0.5 sec) at 758.6 keV, together with a partial level scheme, has been evidenced by studying the decay of ^{93}Sr produced by ^{235}U fission, on either chemically or on-line isotopically separated sources. An E3 (168.4 keV) γ ray depopulates the isomeric level as indicated by its measured half life and conversion coefficient (α_K = 0.73 ± 0.05). The measured β-decay energy is Q_β = 3,900 ± 100 keV. (DE)

16010 DECAY OF 5.7-MINUTES AND 40-MINUTES ^{130}Sb ISOMERS TO LEVELS IN ^{130}Te. Erten, H. N. (Middle East Technical Univ., Ankara (Turkey). Dept. of Chemistry); Blachot, J. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale). Radiochim. Acta; 21: No. 1, 1-7(1974).

7 figs.; 3 tabs.; 31 refs.

The decay schemes of the 5.7-min and 40-min ^{130}Sb isomers separated from ^{235}U fission products were studied using Ge(Li) detectors in singles and coincidence studies. Twenty-five γ-rays have been assigned to the decay of the 40-min isomer and 4 of these plus 12 new γ-rays have been assigned to the decay of 5.7-min isomer. Levels in ^{130}Te are established at 839.5, 1,597.5, 1,632.5, 1,814.5, 1,884.0, 1,967.1, 1,981.5, 2,102, 2,144.9, 2,832, and 2,876 keV. The levels are compared with those from reaction studies and the systematics of the even-A tellurium levels is discussed. (DE)

16011 REMARKS ON THE ^{103}Rh(n,n')^{103m}Rh EXCITATION CURVE. Pazsit, A. (Kossuth Lajos Tudomanyegyetum, Debrecen, Hungary); Peto, G.; Csikai, J.; Jozsa, I.; Basco, J. Int. J. Appl. Radiat. Isot.; 26: No. 10, 621-623(Oct 1975).

The cross sections of the ^{103}Rh(n,n')^{103m}Rh reaction have been measured at 2.7 MeV and 14.8 MeV neutron energies as well as for neutron spectra of ^{252}Cf and ^{239}Pu-α-Be sources; the results are 999 ± 111 mb, 216 ± 26 mb, 757 ± 53 mb and 918 ± 64 mb, respectively. (auth)

16012 MEASUREMENTS OF THE TOTAL INTERNAL CONVERSION COEFFICIENT AND $P_K\omega_K$ PROBABILITY IN THE DECAY OF ^{139}Ce. Pich, J. (Ustav pro Vyzkum, Vyroku a Vyuziti Radioisotopu, Prague); Zderadicka, J.; Dragoun, O. Int. J. Appl. Radiat. Isot.; 26: No. 10, 579-587(Oct 1975).

The total conversion coefficient of the 165.853 keV transition in ^{139}La has been determined to be 0.251 ± 0.002 from measurements of the electron and γ-ray intensities and the source activity. From the x-ray and γ-photon spectra the probability $P_K\omega_K$ has been determined to be 0.639 ± 0.006. Using α_T = 0.251 ± 0.002, α_K = 0.214 ± 0.002, ω_K = 0.906 ± 0.026 and $P_K\omega_K$ = 0.639 ± 0.006 the number of K-x rays and 166 keV photons per disintegration has been calculated to be 0.794 ± 0.009 and 0.799 ± 0.001 respectively, giving a K-x ray to γ-photon ratio of 0.99 ± 0.01. The discrepancy between the experimental and theoretical conversion coefficients is explained by taking the nuclear structure effect into account. (auth)

Nuclear Properties and Reactions, 150 ≤ A ≤ 189

Refer also to abstracts 15941, 15963, 15985, 15992, 16004, and 16028.

16013 (CEA-R-4712) EVALUATION OF THE NUCLEAR CROSS SECTION FOR THE ^{169}Tm(n,2n)^{168}Tm REACTION FROM THRESHOLD TO 20 MeV. Philis, C.; Young, P. G. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92-Montrouge (France)). Dec 1975. 52p. (In French). Dep. NTIS (US Sales Only) $5.50.

An evaluation of the nuclear cross section for the ^{169}Tm(n,2n)^{168}Tm reaction has been completed from threshold to 20 MeV. All the available experimental information were critically reviewed and were normalized to a consistent set of standards. The evaluation is based on such experimental information below 15 MeV and is extrapolated to 20 MeV with a statistical theory calculation. The evaluation data are discussed and compared with theoretical values, and estimates of the uncertainty in the adopted data are provided. (auth)

16014 (ORO-3346-173, pp 3-9) NUCLEAR SYSTEMATICS. 31 Oct 1975.

In nuclear and x-ray spectroscopy with radioactive sources. Eleventh annual progress report, February 1, 1975-January 31, 1976. (Georgia Inst. of Tech., Atlanta (USA). School of Chemistry).

Research progress in nuclear systematics of odd mass nuclei and coupling of an odd nucleon to the core, low energy structure of even-even nuclides, odd-A nuclei and coupling schemes are presented. (SDF)

16015 SCATTERING OF PROTONS AT 400 GeV IN A WIRE ARRAY PLACED AT THE FRONT OF AN ELECTROSTATIC SEPTUM. Durand, A. (Rennes-1 Univ., 35 (France)). Nucl. Instrum. Methods; 127: No. 3, 349-354(15 Aug 1975).

The scattering of protons in a wire array placed at the front of an electrostatic septum is studied by a Monte-Carlo method. The effects of the parameters are examined, i.e., the nature and diameter of the wires, the distance between the axis of the wires, and the length of and distance of the wires array from the septum. In the most favorable conditions such a network would reduce proton loss by approximately 50% in the ejection area. (NL)

16016 THE DECAY OF ^{161}Gd TO ^{161}Tb. Gasser, M.; Kern, J.; Huber, O. (Fribourg Univ. (Switzerland). Inst. de Physique). Nucl. Phys., A; 250: No. 1, 106-126(29 Sep 1975).

The level scheme of ^{161}Tb populated by the β-decay of 3.7 min ^{161}Gd has been studied using Ge(Li) detectors as singles and coincidence γ-ray spectrometers. A total of 130 transitions has been observed. An investigation of the Coriolis coupling between the $\frac{1}{2}^-$[532 spin up] and $\frac{7}{2}^-$[523 spin up] bands is presented. Rotational bands previously only observed in charged particle transfer work are discussed. Several additional levels are suggested. (NL)

16017 AN UPPER LIMIT FOR THE (α,π⁻) REACTION ON ^{181}Ta. Eggermann, J.; Ernst, J.; Mayer-Kuckuk, T.; Schaefers, E.

(Bonn Univ. (F. R. Germany). Inst. fuer Strahlen-und Kernphysik); Erichsen, L. von; Puetz, W. (Bonn Univ. (F. R. Germany). Inst. fuer Physikalische Chemie; Bonn Univ. (F. R. Germany). Abt. Radiochemie). Z. Phys., A; 273: No. 4, 381-384(1975).

3 figs.; 11 refs.

In order to search for traces of the $^{181}Ta(\alpha,\pi^-)^{185}Os$ reaction a foil stack of very pure tantalum was bombarded with an α-beam of 173 MeV. A radiochemical separation method was applied to four parts of the stack. Two sources corresponding to energies above and below the (α,π^-) threshold were obtained and a search was made for contents of ^{185}Os. Using a well shielded Ge(Li) detector, weak 646 keV transitions belonging to ^{185}Os were observed for all samples. Since the origin of this activity is uncertain for the samples below threshold, only an upper limit of 100 nb can be set for the (α,π^-) reaction on ^{181}Ta above threshold. (DE)

16018 TRANSITIONS HAVING THE MULTIPOLARITY M1 + E2 IN ^{169}Tm. Metskhvarishvili, R. Ya.; Sergeenkov, Yu. V.; Elizbarashvili, M. A. (Tbilisi State Univ., USSR). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 3, 72-75(1975).

From 25th all-union conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1975). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 3, 550-554(1975).

M1 + E2-transitions of ^{169}Tm were investigated. The error in determining the relative intensities of the conversion lines is 2 to 4%. The relative internal conversion coefficients on the L-subshells were determined for the pure 130.5 keV E2-transition and the mixed 109.8 keV M1 + E2 transition, as well as the relative ICC on the K- and L-shells for the mixed 177.2 and 198.0 keV M1 + E2 transitions. A fragment of the decay scheme of ^{169}Yb is displayed in Fig. 2. For the 130.5 keV E2-transition with the ratio $L_I : L_{II} : L_{III} = (28.5 \pm 0.9) : (113 \pm 2) : 100$ was obtained. It is in good agreement with the results of other measurements. (auth)

16019 INVESTIGATION OF THE RADIATION FROM ^{153}Tb. Vylov, Ts.; Gromov, I. I.; Gromov, K. Ya. Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 3, 40-48(1975).

From 25th all-union conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1975). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 3, 506-522(1975).

Radioactive terbium isotopes were obtained in the reaction involving the spallation of tantalum and gadolinium by protons having energies of 660 and 120 MeV, respectively. Investigations of the γ-ray spectrum of ^{153}Tb were carried out on spectrometers having Ge(Li)-detectors. The spectra obtained were processed on a "Minsk-2" electronic computer according to the "Icerink" program and on a small "Multi-8" electronic computer of the "Tridac-C" system. Determination of the energies and intensities of the γ-rays was carried out. (auth)

16020 INTERNAL CONVERSION ELECTRONS OF ^{171}Lu IN THE RANGE OF LOW ENERGIES. Artamonova, K. P.; Grigor'ev, E. P.; Zolotavin, A. V.; Sergeev, V. O. (Leningrad State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 3, 49-55(1975).

From 25th all-union conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1975). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 3, 523-531(1975).

Information on low-energy transitions is necessary to analyze the properties of the lower levels of ^{171}Yb and to consider the β-decay of ^{171}Lu. In the present work measurements were carried out of the internal conversion electrons of transitions having $E_\gamma < 100$ keV. Their intensities are compared with the intensity of the 739.7 keV K-line. (auth)

16021 EXCITED STATES OF ^{158}Dy. Aleksandrov, A. A.; Baier, G. Yu.; Vylov, Ts.; Grigor'ev, E. P.; Gromov, K. Ya.; Kalinnikov, V. G. (Joint Inst. for Nuclear Research, Dubna, USSR). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 3, 1-8(1975).

From 25th all-union conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1975). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 3, 458-467(1975).

The results of studying the decay of ^{158}Ho isomers allow the properties of the ^{158}Dy levels to be analyzed. In this analysis, use is made of previously published data on the ^{158}Dy levels which are excited in the nuclear reactions (p, 2nγ), (dd'), (pt), (α, xn) and information on the decay of ^{158}Ho. (6 tables, 3 figures) (auth)

16022 EO TRANSITIONS IN THE DECAY OF ^{152m}Eu (9.3h). Schneider, U.; Hauser, U. (Koeln Univ. (F. R. Germany). 1. Physikalisches Inst.). Z. Phys., A; 273: No. 3, 239-249(Jul 1975).

6 figs.; 2 tabs.; 50 refs.

The conversion electron spectrum of the decay of ^{152m}Eu (9.3h) has been specially investigated for EO transitions with the aid of a magnetic spectrometer and coincidence techniques. Besides the known EO transitions of 685 keV in ^{152}Sm and 615 keV in ^{152}Gd two further pure EO transitions of 432 keV and 1,048 keV have been observed. It is shown that these EO transitions are identical with those observed previously in the decay of ^{152}Tb. No EO transitions could be found from a O^+ state of 1,083 keV in ^{152}Sm. The measured intensities together with the γ spectrum measured by Barrette et al. give a consistent decay scheme of ^{152m}Eu. Furthermore the half-life of the O^+ level at 615 keV in ^{152}Gd was measured using the method of "delayed coincidences." The result was $(0.2 \leq t_{\frac{1}{2}} \leq 2.1) \times 10^{-10}$s. From this the EO transition probability for the level was derived as $(0.3 \leq W_K EO \leq 3.7) \times 10^9 s^{-1}$ and the ρ-value as $0.10 \leq \rho \leq 0.36$. The results are discussed within the framework of the collective model. (DE)

Nuclear Properties and Reactions, 190 ≤ A ≤ 219

Refer also to abstracts 15719, 15963, 15965, and 16014.

16023 (CEA-N-1791, pp 211-212) RESONANCE SCATTERING OF MONOCHROMATIC PHOTON BETWEEN 5 TO 8 MeV NEAR TRITON. Fagot, J.; Lucas, R.; Nifenecker, H.; Martinot, M. [nd]. (In French)

In Department of Nuclear Physics. Progress report, 1 October 1973-30 September 1974. (CEA Centre d'Etudes Nucleaires de Scalay, 91-Gif-sur-Yvette (France). Dept. de Physique Nucleaire).

The elastic scattering of monochromatic photons in the 5 to 8 MeV energy range by various targets (Bi, Pb, Hg, Tl, Ce, Sr, Y, Zr, Ni) is discussed. (FR)

16024 (CEA-N-1791, pp 222-225) ANGULAR DISTRIBUTION AND RANGE OF THE PRODUCTS FROM THE $^{40}Ar + ^{197}Au$ REACTION. Lucas, R.; Nifenecker, H.; Poitou, J.; Ribrag, M. [nd]. (In French)

In Department of Nuclear Physics. Progress report, 1 October 1973-30 September 1974. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Physique Nucleaire).

Angular distributions and ranges of the products of the reaction ^{40}Ar + Au were measured using an X-ray identification of the products. In the range of laboratory angles studied (0 deg-110 deg) no serious departure from the $1/\sin\theta$ distribution is seen for fragments with charges less than 60. A peak around the grazing angle is visible for fragments with charge between 60 and 80. For the higher charges this peak is interpreted as the quasi-elastic peak while for charges 60-70 it seems possible that the peak is caused by quasi-fissions. (FR)

16025 (ORO-3346-173, pp 10-11) EXPERIMENTAL NUCLEAR DECAY SCHEME STUDIES ON CAMPUS. 31 Oct 1975.

In nuclear and x-ray spectroscopy with radioactive sources. Eleventh annual progress report, February 1, 1975-January 31, 1976. (Georgia Inst. of Tech., Atlanta (USA). School of Chemistry).

Research progress in decay scheme studies of transuranium nuclides, ^{189}Pt, ^{149}Nd and measurements of E2 and M4 K conversion coefficients are reported. (SDF)

16026 (ORO-3346-173, pp 12-24) CURRENT UNISOR RESEARCH. 31 Oct 1975.

In nuclear and x-ray spectroscopy with radioactive sources. Eleventh annual progress report, February 1, 1975-January 31, 1976. (Georgia Inst. of Tech., Atlanta (USA). School of Chemistry).

Progress in spectroscopic studies at UNISOR of mass chains A equals 185 through 197, and studies of A equals 115, 116, and 117 isobars are reported. (SDF)

16027 INVESTIGATION OF MULTINUCLEON EMISSION INDUCED BY α-PARTICLES ON ^{197}Au IN THE ENERGY RANGE 20 TO 170 MeV. Djaloeis, A.; Jahn, P.; Probst, H. J.; Mayer-Boericke, C. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik). Nucl. Phys., A; 250: No. 1, 149-162(29 Sep 1975).

Excitation functions of the $^{197}Au(\alpha,xn)^{201-x}Tl(x = 3,\ldots, 11)$ and $^{197}Au(\alpha,pxn)^{200-x}Hg(x = 3, 5, 7)$ reactions have been measured in the energy range 65-170 MeV using the stacked foil technique. For comparison with theory the experimental data were supplemented with those of other experiments at lower energies down to 20 MeV. The data have been analyzed in the framework of the hybrid model assuming that the reaction mechanism can by understood in terms of successive nucleon emission from pre-equilibrium and equilibrium states of the nuclei involved. Particular attention was paid to the question of the initial pre-equilibrium exciton configuration.

The model gives satisfactory reproduction of the experimental data in the whole energy range, somewhat better overall agreement being obtained with the initial exciton number $n_0 = 5(3n-2p-0h$ initial configuration) rather than with $n_0 = 4(2n-2p-0h)$. The significance of the initial exciton number with respect to its absolute value and its bearing to the internal structure is discussed. (NL)

16028 COMPLETE FUSION AND QUASI-FISSION REACTIONS INDUCED BY ^{84}Kr IONS ON HEAVY TARGETS. Peter, J.; Ngo, C.; Tamain, B. (Paris-11 Univ., 91-Orsay (France). Div. de Physique Nucleaire). Nucl. Phys., A; 250: No. 2, 351-363(6 Oct 1975).

Cross sections for fission (complete fusion) and quasi-fission are measured at a given angle for the systems Kr + Ho, Kr + W, Kr + Bi, Kr + U in the energy range 450-525 MeV. The cross sections for complete fusion are unexpectedly low and the cross sections for quasi fission are high. The cross section for close collisions (sum of the complete fusion and quasi-fission cross sections) is compared to the value calculated with the critical distance concept. The possibility that complete fusion does not occur for the lowest impact parameter is discussed. (NL)

16029 MICROSCOPIC DESCRIPTION OF DECOUPLED $h_{11/2}$ BANDS. The Negative Parity Spectra of the Au Nuclei. Hecht, K. T. (Michigan Univ., Ann Arbor (USA). Dept. of Physics). Phys. Lett., B; 58: No. 3, 253-256(15 Sep 1975).

The decoupled $h_{11/2}$ bands in Au nuclei are investigated in the framework of a shell model description based on the coupling of an $h_{11/2}$ proton hole to core proton states approximated by the leading representation $(\lambda\,\mu) = (06)$ of the pseudo SU_3 coupling scheme for the positive parity of the proton configuration. (NL)

16030 IN-BEAM α- AND γ-RAY SPECTROSCOPY FOR ^{216}Ra. Nomura, T., Hiruta, K.; Yoshie, M.; Ikezoe, H.; Fukuda, T.; Hashimoto, O. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)). Phys. Lett., B; 58: No. 3, 273-276(15 Sep 1975).

By a simultaneous observation of α-particle decays and γ-rays in the ^{208}Pb(^{12}C, 4n) and ^{207}Pb(^{12}C, 3n) reactions, extremely short-lived long-range α-particle decays from high-spin states in ^{216}Ra were found and their decay properties established. The level sequence of ^{216}Ra was established up to 11- (possibly 14^+). (NL)

16031 NUCLEAR SPIN MEASUREMENTS ON NEUTRON-DEFICIENT ISOTOPES OF THE REFRACTORY ELEMENTS. Rubinsztein, H.; Gustafsson, M. (Chalmers Tekniska Hoegskola, Goeteborg (Sweden). Institutionen foer Fysik). Phys. Lett., B; 58: No. 3, 283-285(15 Sep 1975).

Nuclear ground and isomeric state spins of several isotopes of the refractory elements (Y, Nb, Mo, Tc, Rh, Ta, Re, Os, Ir, Pt) measured by the atomic beam magnetic resonance method, are reported. The atomic ground-state g-factor for the Os atom has also been measured. (NL)

16032 MEASUREMENTS OF THE NEUTRON CAPTURE CROSS SECTIONS OF GOLD-197 AND URANIUM-238 BETWEEN 20 AND 3500 keV. Poenitz, W. P. (Argonne National Lab., IL). Nucl. Sci. Eng.; 57: No. 4, 300-308(Aug 1975).

Absolute measurements of the capture cross section of ^{197}Au were carried out in the 400- to 3500-keV energy range. Ratios of the capture cross sections of ^{238}U to ^{197}Au were measured from 20 to 1200 keV. Values for ^{238}U were derived by utilizing evaluated and present data for ^{197}Au. The time-of-flight technique and a large liquid scintillator were used for the detection of the prompt capture gamma rays, and the Grey Neutron Detector, the Black Neutron Detector, and a ^{6}Li-glass detector were used for the measurement and monitoring of the neutron flux. Results support previous measurements of the ^{238}U capture cross section and resolve some existing discrepancies. The absolute values for the capture cross section of ^{197}Au agree well with evaluated data and measurements reported relative to the ^{235}U fission cross section. (7 figures, 3 tables) (auth)

16033 EVIDENCE FOR TWO-PARTICLE CORE POLARIZATION IN THE ISOMERIC $^{29}/_2{}^+$ AND $^{21}/_2{}^-$ STATES OF THE $\pi(h_{9/2}^2)_{8+}i_{13/2}\nu(j^{-2})_{8+}$ AND $\pi(h_{9/2}^2)\nu(j^{-2})_{8+}$ CONFIGURATIONS IN ^{209}At. Bergstroem, I.; Herrlander, C. J.; Lindblad, T.; Rahkonen, V.; Rensfelt, K. G.; Westerberg, K. (Forskningsinstitutet foer Atomfysik, Stockholm (Sweden)). Z. Phys., A; 273: No. 3, 291-304 (Jul 1975).

14 figs.; 4 tabs.; 25 refs.

Using α-particles in the energy range 42-51 MeV, the ^{209}Bi(α,4n) ^{209}At reaction was studied with the intention of investigating the properties of excited high spin states in ^{209}At. In-beam prompt and delayed γ-ray and conversion electron spectroscopy reveal two isomeric states at 2,429 and 1,428 keV having the half-lives of 875 ± 100 ns and 25 ± 1 ns, respectively. The spins and parities of these states are found to be $^{29}/_2{}^+$ and $^{21}/_2{}^-$, respectively. The g-factors of the isomeric states are 1.06 ± 0.02 and 0.88 ± 0.06, which, within the experimental errors, are the same as the g-factors of the corresponding states in ^{211}At. This suggests that the isomeric states are due to the $\pi(h_{9/2}^2)_{8+}i_{13/2}\nu(j^{-2})_{8+}$ and $\pi(h_{9/2}^2)\nu(j^{-2})_{8+}$ configurations, respectively. The deviation between the calculated and experimentally found excitation energies of the isomeric levels are −146 ± 26 and +72 ± 26 keV. This deviation which in cases of a ^{208}Pb-core usually is smaller than 15 keV, is likely to be due to the neglect of the interaction between two particles via the exchange of virtual 2^+ phonons in the ^{208}Pb core. This two-particle polarization interaction is found to be approximately described by a P_2-force. (DE)

16034 FISSION OF GOLD BY MEANS OF 580 MeV PROTONS. Ross, E.; Baechmann, K. (Technische Univ. Darmstadt (F. R. Germany). Fachbereich Anorganische Chemie und Kernchemie). Radiochim. Acta; 21: No. 1, 13-20(1974). (In German)

8 figs.; 9 tabs.; 46 refs.

The thick target and thick catcher method combined with non-destructive γ-spectroscopy was employed to determine the cross sections and recoil properties of some nuclides which have been produced in the bombardment of gold with 580 MeV protons. The mass range in the investigation was $46 \leq A \leq 110$ most nuclides having mass numbers between 83 and 96. The charge dispersion curve and the mass-yield-curve for this latter mass range have been calculated from the experimental results as well as the average kinetic energy, mean momentum, and cascade deposition energy for each observed product. These data show a good qualitative and quantitative agreement with values which are characteristic for fission products. It is therefore concluded that products of mean masses are produced at 580 MeV proton energy from gold mainly by fission or a fission-like process. (DE)

16035 Au 197(n,γ) Au 198 CROSS SECTION MEASUREMENTS BETWEEN 0.2 AND 3.0 MeV. Paulsen, A.; Widera, R.; Liskien, H. (Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements). Atomkernenergie; 26: No. 2, 80-83(1975).

1 fig.; 2 tabs.; 22 refs.

Cross sections for the standard capture reaction Au 197 (n,γ) Au 198 were measured between 0.2 and 3.0 MeV neutron energy with an accuracy better than ±5% by means of the sample activation technique. Quasi-monoenergetic neutrons were produced at the 3.7 MV Van de Graaff accelerator of the CBNM and the neutron fluences were determined by a proton recoil proportional or telescope counter. (DE)

16036 PHOTONEUTRON FINE STRUCTURE IN ^{208}Pb AND MULTIPOLE RESONANCE. Sherman, N.K.; Ferdinande, H.M.; Lokan, K.H.; Ross, C.K. (Division of Physics, National Research Council of Canada, Ottawa, Canada K1A 0R6). Phys. Rev. Lett. 35: No. 18, 1215-1219 (3 Nov 1975).

We have observed more than fifty peaks between 400 keV and 4 MeV in photoneutron spectra of ^{208}Pb. Transitions occur to the ground state and first two excited states of ^{207}Pb from discrete absorption features, some of which are less than 100 keV wide even above 11 MeV. Three states, the most prominent of which is at 9.034 MeV, underlie a controversial electron-scattering resonance, supporting an *E2* rather than *E0* interpretation. (auth)

16037 MULTIPOLE ASSIGNMENT OF THE 8.9-MeV RESONANCE IN ^{208}Pb. Schwierczinski, A.; Frey, R.; Richter, A.; Spamer, E.; Theissen, H.; Titze, O. (Institut für Kernphysik, Technische Hochschule Darmstadt, 61 Darmstadt, West Germany); Walcher, Th.; Krewald, S.; Rosenfelder, R. Phys. Rev. Lett. 35: No. 18, 1244-1247 (3 Nov 1975).

High-resolution inelastic electron scattering [full width at half-maximum (FWHM) $\simeq$38 keV] with 50-MeV electrons on ^{208}Pb yields a width $\Gamma = 1.3 \pm 0.2$ MeV for the 8.9-MeV resonance. This result together with the results from a reanalysis of older data with moderate energy resolution (FWHM$\simeq$300 keV) shows that the previous identification of the 8.9-MeV resonance as a monopole excitation is not conclusive. The excitation of this state may as well be *E2*. The giant quadrupole resonance at 10.8 MeV seen in former measurements has been reanalyzed. (auth)

16038 CALCULATIONS OF ELECTRON ENERGY DISTRIBUTIONS FOR INTERNAL IONIZATION DURING THE ALPHA DECAY OF ^{210}Po EMPLOYING THE BINARY-ENCOUNTER APPROXIMATION. Watson, R.L. (Department of Chemistry and Cyclotron Institute, Texas A&M University, College Station, Texas 77843). Phys. Rev. A 12: No. 6, 2628-2630 (Dec 1975).

The description of internal ionization during α decay, as developed by Hansen, is reexamined and extended to the calculation of the ejected-electron energy distributions. The results are compared with recent experimental data for the decay of ^{210}Po. (auth)

Nuclear Properties and Reactions, A ≥ 220

Refer also to abstracts 15910, 16028, 16032, 16067, and 16334.

16039 (BNL-NCS-50451) SEMINAR ON ^{238}U RESONANCE CAPTURE, UPTON, NEW YORK, MARCH 18–20, 1975. Pearlstein, S. (ed.). (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. Contract E(30-1)-16. 264p. (CONF-750323-; ENDF-217; NEACRP-L-147; NEANDC(US)-192/L; INDC(US)-69/L) Dep. NTIS $11.25.

21 papers are abstracted separately and appear in both Nuclear Science Abstracts and ERDA Energy Research Abstracts. (SDF)

For abstracts of individual papers see: 15907–15911, 16040–16049, 16357–16359, and 16472–16474.

16040 (BNL-NCS-50451, pp 45-66) CURRENT UK POSITION ON ^{238}U RESONANCE CAPTURE. Askew, J. R. (Atomic Energy Establishment, Winfrith, Eng.). Mar 1975.

From proceedings of 238U resonance capture; Upton, New York, USA (18 Mar 1975).

In seminar on the ^{238}U resonance capture. (Brookhaven National Lab., Upton, N. Y. (USA)).

The paper reviews the large body of integral evidence on Uranium-238 resonance capture accumulated since 1966, when attention was first drawn to a discrepancy between integral evidence and calculated results based upon differential data. The experiments cover many reactor types, laboratories and measurement techniques, and include studies of isotopic composition of discharged fuel. It is shown that the discrepancy still exists, although changes in other data (particularly Uranium-235 resonance capture) have reduced the size of the deduced discrepancy to 4 to 8 percent. It is argued that the differences are within the uncertainties of measurement of parameters for the low lying resonances which dominate thermal reactor calculations. These were originally believed to be more accurate because it was thought acceptable to assume capture widths invariant and to average them over many resonances. Once this is not permitted the differences become explicable. 2 figures, 13 tables (auth)

16041 (BNL-NCS-50451, pp 81-86) EFFECTIVE ^{238}U RESONANCE INTEGRALS IN CLUSTERS OF NATURAL URANIUM FUELPINS DERIVED FROM CRNL LATTICE MEASUREMENTS. Griffiths, J. Mar 1975.

From proceedings of ^{238}U resonance capture; Upton, New York, USA (18 Mar 1975).

In seminar on the ^{238}U resonance capture. (Brookhaven National Lab., Upton, N.Y. (USA)).

Lattice parameters, fast fission ratio, initial conversion ratio, thermal neutron fine structure, thermal neutron spectrum parameters and buckling, have been measured at CRNL for a wide range of natural uranium lattices. The lattices consisted of regular arrays of fuel clusters, containing natural U metal, UO_2, UC, U_3Si/Al cooled by D_2O, AIR, organic liquid and in a few cases H_2O, in D_2O moderator, for a wide range of lattice pitches. ^{238}U resonance absorption rates in these lattices can be derived from the lattice parameters. These absorption rates have been related to effective ^{238}U resonance integrals by means of the EPITHET computer code. (auth)

16042 (BNL-NCS-50451, pp 87-94) ADJUSTMENT OF THE EFFECTIVE ^{238}U RESONANCE INTEGRAL TO FORCE AGREEMENT WITH INTEGRAL DATA. Edenius, M. (AB Atomenergi, Studsvik, Sweden). Mar 1975.

From proceedings of ^{238}U resonance capture; Upton, New York, USA (18 Mar 1975).

In seminar on the ^{238}U resonance capture. (Brookhaven National Lab., Upton, N.Y. (USA)).

A resonance treatment in an advanced cell code (CASCO) is used to calculate the resonance absorption in isolated fuel rods surrounded by a large moderating region and to normalize the calculated resonance integrals to experimentally determined expressions for the resonance integral. Corrections to the effective ^{238}U resonance integral are suggested and examples of how such corrections improve lattice calculations are given. (SDF)

16043 (BNL-NCS-50451, pp 95-102) PRECISE MEASUREMENT AND CALCULATION OF ^{238}U NEUTRON TRANSMISSIONS. Olsen, D. K.; de Saussure, G.; Silver, E. G.; Perez, R. B. (Oak Ridge National Lab., TN). Mar 1975.

From proceedings of ^{238}U resonance capture; Upton, New York, USA (18 Mar 1975).

In seminar on the ^{238}U resonance capture. (Brookhaven National Lab., Upton, N.Y. (USA)).

The total neutron cross section of ^{238}U has been measured above 0.5 eV in precise transmission experiments and results are compared with ENDF/B-IV. Emphasis has been on measuring transmissions through thick samples in order to obtain accurate total cross sections in the potential-resonance interference regions between resonances. 4 figures, 1 table. (SDF)

16044 (BNL-NCS-50451, pp 103-121) ^{238}U(n,gamma) CROSS SECTION ABOVE THE RESONANCE REGION. Perez, R. B.; Spencer, R. R.; de Saussure, G. (Oak Ridge National Lab., TN). Mar 1975.

From proceedings of ^{238}U resonance capture; Upton, New York, USA (18 Mar 1975).

In seminar on the ^{238}U resonance capture. (Brookhaven National Lab., Upton, N.Y. (USA)).

A number of measurements of the ^{238}U(n, gamma) cross section above the resonance region have been completed in the past few years. In the keV range, these measurements suggest a considerable amount of intermediate structure. Comparisons are made of pre-1970 and more recent evaluations with ENDF/B-IV results. Discrepancies and uncertainties are discussed. (SDF)

16045 (BNL-NCS-50451, pp 122-146) EVALUATION OF ^{238}U CROSS SECTIONS FOR ENDF/B-IV. McCrosson, F. J. (E. I. du Pont de Nemours and Co., Aiken, SC). Mar 1975.

From proceedings of ^{238}U resonance capture; Upton, New York, USA (18 Mar 1975).

In seminar on the ^{238}U resonance capture. (Brookhaven National Lab., Upton, N.Y. (USA)).

Evaluation of ^{238}U neutron cross sections below 4 keV is discussed, emphasizing thermal and epithermal cross sections, s and p wave resonances, background cross sections, and the impact of new ENDF/B-IV evaluations on thermal lattice calculations. Several possible deficiencies in the Version III ^{238}U cross sections have been proposed. 15 tables. (SDF)

16046 (BNL-NCS-50451, pp 147-150) COMMENTS ON THE ^{238}U DISCREPANCY. Chrien, R. E. (Brookhaven National Lab., Upton, N.Y.) Mar 1975.

From proceedings of ^{238}U resonance capture; Upton, New York, USA (18 Mar 1975).

In seminar on the ^{238}U resonance capture. (Brookhaven National Lab., Upton, N.Y. (USA)).

The problem of overprediction of neutron capture by ^{238}U using commonly accepted resonance parameters from the ENDF/B-IV file is briefly considered. (SDF)

16047 (BNL-NCS-50451, pp 151-155) CAPTURE WIDTH OF THE 6.67 eV LEVEL IN ^{238}U. de Saussure, G.; Perez, R. B. (Oak Ridge National Lab., TN). Mar 1975.

From proceedings of ^{238}U resonance capture; Upton, New York, USA (18 Mar 1975).

In seminar on the ^{238}U resonance capture. (Brookhaven National Lab., Upton, N.Y. (USA)).

In a comparison between a Monte Carlo calculation and a measurement of the capture probability in a thick sample of ^{238}U it has been suggested that the width of the 6.67 eV level might be appreciably smaller than the value 25.6 MeV, evaluated in Version III and IV of ENDF/B. A few comments are made on this topic. (SDF).

16048 (BNL-NCS-50451, pp 163-166) REVIEW OF BENCHMARK EXPERIMENTS. Sher, R.; Fiarman, S. (Stanford Univ., New York). Mar 1975.

From proceedings of ^{238}U resonance capture; Upton, New York, USA (18 Mar 1975).

In seminar on the ^{238}U resonance capture. (Brookhaven National Lab., Upton, N.Y. (USA)).

Some possible systematic errors in reaction rate measurements in lattices are discussed, which might be correctable, even at this late date. These include streaming through catcher foils or gaps, fast source perturbations due to the use of depleted uranium detectors and cadmium, and cadmium cut-off effects. (auth)

16049 (BNL-NCS-50451, pp 255-264) ^{238}U RESOLVED RESONANCE PARAMETERS AND THEIR INFLUENCE ON CAPTURE CROSS-SECTIONS. Bhat, M. R. (Brookhaven National Lab., Upton, NY). Mar 1975.

From proceedings of ^{238}U resonance capture; Upton, New York, USA (18 Mar 1975).

In seminar on the ^{238}U resonance capture. (Brookhaven National Lab., Upton, N.Y. (USA)).

The experimental data on the resonance parameters of the first four resolved resonances of ^{238}U are reviewed. The purpose of such a review is (1) to estimate the errors in the resonance parameters and (2) to determine how far the parameters could be reasonably changed within the bounds determined by the experimental uncertainties in the thermal capture cross-section and the infinitely dilute resonance capture integral. The effect of changing the gamma

width of the individual resonances is studied and its effect on the effective resonance integral determined. 2 tables. (auth)

16050 (CEA-R-4715) EXPERIMENTAL STUDY OF THE ^{239}Pu(d,pf) REACTION: VARIATION OF KINETIC ENERGY AND FRAGMENT MASS DISTRIBUTION WITH FISSIONING NUCLEUS EXCITATION ENERGY. Lachkar, J. C.; Sigaud, J.; Patin, Y.; Chardine, J.; Humeau, C. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92-Montrouge (France)). Nov 1975. 52p. (In French). Dep. NTIS (US Sales Only) $5.50.

Dynamical effects in the fission process of the ^{240}Pu nucleus have been investigated from the ^{239}Pu(d,pf) reaction. In the excitation energy range from 4.1 to 9.5 MeV, the energy dependence of the following characteristics of fission have been studied: fission probability, fragment angular anisotropy, average value of the overall total fragment kinetic energy, average value of the total fragment kinetic energy versus heavy fragment mass, average value of the heavy fragment mass. The results have been investigated together with those from studies of spontaneous fission and isomeric fission and those giving the number of neutrons emitted by neutron induced fission as reported by other authors. The data show evidence for a vibrational state at about 4.65 MeV weakly coupled to compound II-class states. Moreover it has been found that the fragment mass and kinetic energy distributions present different behaviors in two ^{240}Pu excitation energy ranges. The first one is related to the ground state, the isomeric state and the state at 4.65 MeV, the second one to states of excitation energy higher than 4.75 MeV. These two behaviors tend to illustrate the existence of two modes of fission, the first one is superfluid, the other is strongly damped in the last stages of the fission process. (9 figures, 5 tables) (auth)

16051 (IEA-324) INTERMEDIATE STRUCTURE IN THE PHOTONEUTRON AND PHOTOFISSION CROSS SECTIONS IN ^{238}U AND ^{232}Th. Mafra, O. Y.; Kuniyoshi, S.; Goldemberg, J. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Jan 1974. 21p. Dep. NTIS (US Sales Only) $3.50.

The (γ,f) and (γ,n) cross sections in ^{238}U and ^{232}Th and the ratio Γ_n/Γ_f were measured with monochromatic γ-rays, of energies from 5.43 to 9.0 MeV. The competition between the two processes and the implication of the cross-section behaviour are discussed. (17 figures, 4 tables) (auth)

16052 (JINR-E4-9254) IRREGULARITY IN THE BEHAVIOR OF THE RADIATION STRENGTH FUNCTION IN ^{238}U. Voronov, V. V.; Soloviev, V. G. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 8p. Dep. NTIS (US Sales Only) $4.50.

It is shown that the irregularity in the behavior of radiation strength function in the reaction ^{238}U(γ,n) ^{237}U is due to the increase of the density of two-quasiparticle states with $I^{\pi} = 1^-$ having large matrix elements for E1-transitions from the ground state of ^{238}U. (2 figures) (auth)

16053 HOW TO CREATE ARTIFICIALLY VERY HEAVY ELEMENTS. Lefort, M. (Paris-11 Univ., 91-Orsay (France). Inst. de Physique Nucleaire). Sci. Tech. (Paris); No. 24, 14-21 (15 Jun 1975). (In French)

The definition of stable and unstable elements is recalled and the reasons for the instability of some nuclei are analyzed. The radioactivity phenomenon (in particular that of heavy nuclei) is described, and it is shown how first transuranium elements were obtained. The limit to the existence of too heavy nuclei is discussed and experiments with heavy ion beams carried out to produce transuranium elements are presented. (FR)

16054 HALF-LIFE OF ^{239}Pu. Aleksandrov, B. M.; Antsiferov, V. T.; Bulyanitsa, L. S. (Radium Inst., Leningrad). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 3, 20-25(1975).

From 25th all-union conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1975). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 3, 482-488(1975).

The radiometric method was used to measure the half-life of ^{239}Pu. In order to increase the accuracy and reliability of the results the Coulometric procedure was used for weighing plutonium, while the activity of the plutonium in the sources was measured by the method of $4\pi\alpha$-X coincidence. A detailed analysis of the error of the measurements is made. (5 tables) (auth)

16055 NEW CALORIMETRIC DETERMINATION OF THE HALF-LIFE OF ^{241}Am. Ramthun, H. (Physikalisch-Technische Bundesanstalt, Braunschweig, Ger.); Muller, W. Int. J. Appl. Radiat. Isot.; 26: No. 10, 589-593(Oct 1975). (In German)

Commercially available americium oxide of about 98% purity was refined by ion exchange, extraction chromatography and oxalate precipitation. After reduction with lanthanum to americium metal, it was further purified by repeated sublimation at 1100°C and a pressure of less than 1.3×10^{-4} Pa. The remaining impurity content was determined by spectroscopic analysis to be 0.65‰. The amount of ^{237}Np formed by decay of ^{241}Am after the last sublimation was calculated to be 0.55‰. Repeated determinations of the heat output in a twin microcalorimeter resulted in 7659.8 μW. From this value and from the ^{241}Am mass of 66.783 mg the specific heat output of 0.1147 W/g, the half-life of 432 yr and the decay constant of 5.084×10^{-11} sec^{-1} were calculated. (auth)

16056 MEASUREMENT OF THE ENERGY SPECTRUM OF PROMPT NEUTRONS FROM THE FISSION OF ^{239}Pu BY 0.215 MeV NEUTRONS. Knitter, H. H. (Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements). Atomkernenergie; 26: No. 2, 76-79(1975).

3 figs.; 21 refs.

The energy spectrum of prompt neutrons emitted in the fission of ^{239}Pu induced by 0.215 MeV neutrons was measured in the energy range from 0.25 to 15 MeV using nanosecond time-of-flight technique. A pulsed Van de Graaff accelerator was used to produce the primary neutrons. Considerable care was taken to measure the energy dependence of the neutron detector efficiency. The shape of the resulting spectrum agrees with a Maxwellian distribution within the experimental uncertainties. An average fission neutron energy of $\bar{E} = 2.136 \pm 0.045$ MeV was obtained. (DE)

16057 ARE THERE FISSION-FRAGMENT ENERGY VARIATIONS IN ^{235}U NEUTRON RESONANCES? Weigmann, H.; Wartena, J.A. (Central Bureau for Nuclear Measurements, EURATOM, B-2440 Geel, Belgium); Wagemans, C. Phys. Rev. Lett. 35: No. 18, 1213-1215 (3 Nov 1975).

Measurements have been made to check recent findings of fission-fragment energy variations in low-energy neutron resonances of ^{235}U. The result has been negative. (auth)

16058 SEQUENCE OF SUBBARRIER FISSION RESONANCES IN ^{236}U. Goldstone, P.D.; Hopkins, F.; Malmin, R.E.; Paul, P. (Department of Physics, State University of New York, Stony Brook, New York 11794). Phys. Rev. Lett. 35: No. 17, 1141-1143 (27 Oct 1975).

The reaction ^{235}U$(d,p)^{236}$U(f) was studied at E_d=13, 15, and 17 MeV with θ_p=60° and 140°. The proton spectra in coincidence with fission fragments show a series of new narrow subbarrier resonances in ^{236}U above the known resonance at E_x=5.12 MeV. These are interpreted as vibrational modes orthogonal to and coupled weakly to the $K=0^+$ fission vibration. Resonance centroids and experimental widths are extracted. (auth)

Nuclear Theory

Refer also to abstract 15983.

16059 (INS-J-153) UNIFIED PERSPECTIVE OF NUCLEAR PHASE TRANSITIONS IN EVEN-EVEN NUCLEI. Sakai, M. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). 3 Oct 1975. 14p. Dep. NTIS (US Sales Only) $3.50.

Three types of phase transition in an even-even nucleus, namely, from spherical to deformed state, from oblate to prolate state and from super to normal state have been treated in a unified way by introducing a new quantity $\Delta J/\Delta I$, that is, change of the moment of inertia by unit increase of the angular momentum. It is shown that the curves of $\Delta J/\Delta I$ vs. the neutron number N, the angular momentum I or the excitation energy E behave in a characteristic way depending on the types of the phase transition to provide a powerful tool for investigating these phenomena. The J_0 values after the phase transition from the super to the normal state were found to take the same functional form of A_s as that of the moment of inertia of rigid body J_{rig} with which the nucleus is supposed to rotate after the phase transition. The determined ratio of $J_0/J_{rig} = 0.85$ is consistent with an interpretation that the nuclear collapse occurs first in the neutron core. (14 figures) (auth)

16060 (IPNO-CF-75-1, pp 1-26) INTRODUCTION TO THE SPECTRAL DISTRIBUTION METHOD. Application Example to the Subspaces With a Large Number of Quasi Particles. Arvieu, R. [nd]. (In French)

From 6th meeting on the Theoretical Physics Division; Aussois, France (5 Apr 1974).

In proceedings of the sixth meeting of the Theoretical Physics Division. Aussois, 5-10 April 1974. (Paris-11 Univ., 91-Orsay (France). Inst. de Physique Nucleaire).

The assumptions and principles of the spectral distribution method are reviewed. The object of the method is to deduce information on the nuclear spectra by constructing a frequency function which has the same first few moments, as the exact

frequency function, these moments being then exactly calculated. The method is applied to subspaces containing a large number of quasi particles. (FR)

16061 (IPNO-CF-75-1, pp 27-60) FIXED J AND T NUCLEAR STATE DENSITIES IN SHELL MODELS. Jacquemin, C. [nd]. (In French)

From 6th meeting of the Theoretical Physics Division; Aussois, France (5 Apr 1974).

In proceedings of the sixth meeting of the Theoretical Physics Division. Aussois, 5-10 April 1974. (Paris-11 Univ., 91-Orsay (France). Inst. de Physique Nucleaire).

An exact calculation of the two first moments of the Hamiltonian operator over fixed (J,T) subspaces is shown, Gaussian approximated (J,T) fixed spectral distributions are then built-up and the accuracy of the spin cut off factor approximation is tested. (FR)

16062 (IPNO-CF-75-1, pp 377-414) BARYON RESONANCE COMPONENTS OF NUCLEAR WAVE FUNCTIONS. Kisslinger, L. [nd].

From 6th meeting of the Theoretical Physics Division; Aussois, France (5 Apr 1974).

In proceedings of the sixth meeting of the Theoretical Physics Division. Aussois, 5-10 April 1974. (Paris-11 Univ., 91-Orsay (France). Inst. de Physique Nucleaire).

A related aspect of ordinary nuclear states is treated: the presence of baryonic resonances which results from the interactions of nucleons with each other, and the consequences for nuclear properties and reactions. (FR)

16063 (IPNO-CF-75-1, pp 61-75) HEAVY ION COLLISIONS. Theoretical Aspects. da Silveira, R. [nd]. (In French)

From 6th meeting of the Theoretical Physics Division; Aussois, France (5 Apr 1974).

In proceedings of the sixth meeting of the Theoretical Physics Division. Aussois, 5-10 April 1974. (Paris-11 Univ., 91-Orsay (France). Inst. de Physique Nucleaire).

Some theoretical aspects of heavy ion collisions: coulomb fission, interference effects and quasi elastic as well as deep inelastic transfers, are briefly discussed in these lecture notes. (FR)

16064 (IPNO-CF-75-1, pp 76-118) HEAVY ION REACTIONS. Experimental Aspects. Bimbot, R. [nd]. (In French)

From 6th meeting of the theoretical physics Division; Aussois, France (5 Apr 1974).

In proceedings of the sixth meeting of the Theoretical Physics Division. Aussois, 5-10 April 1974. (Paris-11 Univ., 91-Orsay (France). Inst. de Physique Nucleaire).

The kinematic features of various kinds of heavy-ion induced reactions (elastic and inelastic scattering, quasi-elastic and deep-inelastic transfers, complete fusion) are given, with the corresponding range of angular momentum. Then some typical problems associated with very heavy projectiles are discussed, namely the very small value of the complete fusion cross section, and the significant value of the incomplete fusion cross section. Finally, the problem of the possible limitations to complete fusion is analyzed in details: the concept of critical angular momentum is defined and the principle of its determination is given. It is shown that the concept of critical distance of approach leads to a better understanding of experimental data. (FR)

16065 (IPNO-CF-75-1, pp 147-173) STATIC CALCULATIONS OF HEAVY ION-HEAVY ION POTENTIALS. Flocard, H. [nd]. (In French)

From 6th meeting of the Theoretical Physics Division; Aussois, France (5 Apr 1974).

In proceedings of the sixth meeting of the Theoretical Physics Division. Aussois, 5-10 April 1974. (Paris-11 Univ., 91-Orsay (France). Inst. de Physique Nucleaire).

The principles of a static calculation of heavy ion potential energy curves are briefly presented. The problems of the interpretation of these curves are discussed. The static method is compared to that of time dependent Hartree-Fock (adiabatic or not). The numerical methods used in heavy ion potential calculations are also presented and some results obtained within the slow and sudden approximations are discussed. (FR)

16066 (IPNO-CF-75-1, pp 174-202) RECONSTITUTION OF THE PURELY ELASTIC SCATTERING AMPLITUDE OF PARTICLES WITHOUT SPIN, KNOWING THE DIFFERENTIAL CROSS-SECTION. Cornille, H. [nd]. (In French)

From 6th meeting of the Theoretical Physics Division; Aussois, France (5 Apr 1974).

In proceedings of the sixth meeting of the Theoretical Physics Division. Aussois, 5-10 April 1974. (Paris-11 Univ., 91-Orsay (France). Inst. de Physique Nucleaire).

The problem of reconstituting the scattering amplitude from the experimental differential cross-section received recently new developments. Here is studied the case of spinless particles in the purely elastic region of energy. (FR)

16067 (IPNO/TH-75-12) NUCLEAR GROUND STATE PROPERTIES WITH THE SKYRME INTERACTION. Flocard, H. (Paris-11 Univ., 91-Orsay (France). Inst. de Physique Nucleaire). Feb 1975. 37p. (CONF-750233-5). Dep. NTIS (US Sales Only) $4.00.

From conference on Hartree-Fock and self consistent field theories in nuclei; Trieste, Italy (24 Feb 1975).

Some of the results concerning nuclear ground state properties obtained by Hartree-Fock calculations using the Skyrme's force are summarized. It is shown that a Skyrme Hartree-Fock method is able to reproduce the total binding energies of all nuclei of the chart table with a maximal discrepancy of 5 MeV. Charge radii and single particle spectra are also correctly calculated. The extrapolation to exotic sodium isotopes and superheavy elements is presented and discussed. (8 tables, 14 figures, 41 references) (auth)

16068 (IPNO/TH-75-14) HOW GOOD ARE HARTREE-FOCK CHARGE DENSITIES? Campi, X. (Paris-11 Univ., 91-Orsay (France). Inst. de Physique Nucleaire). Feb 1975. 25p. (CONF-750233-4). Dep. NTIS (US Sales Only) $3.50.

From conference on Hartree-Fock and self consistent field theories in nuclei; Trieste, Italy (24 Feb 1975).

The principle characteristics of Hartree-Fock charge densities (mean square radius, surface thickness, quantum fluctuation) calculated using different effective interactions are discussed in terms of their nuclear matter properties (Fermi momentum, effective mass, incompressibility). A comparison with the experimental charge distributions is made. Differences between the charge densities of neighboring nuclei (isotope and isotone shifts) are also considered and the main factors governing these effects are discussed. (8 figures, 3 tables) (auth)

16069 (IPNO-TH-75-21) MESON CURRENTS IN NUCLEI. Hadjimichael, E. (Paris-11 Univ., 91-Orsay (France). Inst. de Physique Nucleaire). May 1975. 19p. INIS.

From conference on mesonic effects in nuclei; Saclay, France (12 May 1975).

The different methods for obtaining the mesonic-exchange current (two-body currents) in nuclei are described. The current arises from the same mechanism which is responsible for the strong interactions between nucleons and modifies the electromagnetic and weak properties of nuclei. There follows a discussion of the details of the model that has been used most often, which is known as the diagrammatic model. Results which were obtained in all cases when this model was applied are presented and discussed in some detail. (FR)

16070 (JINR-P4-9194) SHELL ENERGIES OF RAPIDLY ROTATING NUCLEI: GENERAL FORMULATION. Neergard, K.; Pashkevich, V. V.; Frauendorf, S. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 18p. (In Russian). Dep. NTIS (US Sales Only) $3.50.

A theory for the shell corrections to the deformation energy of rapidly rotating nuclei is developed. Estimates for the effects due to the nuclear matter compressibility and the two-body spin-exchange and spin-orbit interactions are given. The convexity condition of the energy as a function of the angular momentum is discussed. (auth)

16071 (JINR-P4-9195) SHELL ENERGIES OF RAPIDLY ROTATING NUCLEI. The Description of the Model and Method of Calculation. Neergord, K.; Pashkevich, V. V.; Frauendorf, S. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 22p. (In Russian). Dep. NTIS (US Sales Only) $3.50.

A specific model for investigating the shell corrections to the deformation energies of rapidly rotating nuclei is proposed. Triaxial ellipsoidal shapes are considered. Possible ways of improving the model are discussed. (2 figures, 2 tables) (auth)

16072 COLLECTIVE PAIRING STATES AND NON-UNITARY REPRESENTATIONS OF THE QUASI-SPIN GROUP. Lorazo, B. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Phys. Lett., B; 58: No. 3, 257-260(15 Sep 1975).

Some months ago, a parameter-dependent (p_i)-quasi-spin group was presented by the author. The interest for considering such a group was partly suggested by the possibility of describing, with a reasonable accuracy, the ground state of even spherical nuclei with one closed shell by a n-pair wave function $[\Sigma_i p_i S_i^+]^n/0$ depending upon the real parameters p_i (the operators S_i^+ are the one-orbit quasi-spin operators). It was stated that the formalism would provide the exact mathematical framework to discuss the generalized seniority quantum number. The relevance of this

point of view has been vigorously questioned. For the author of the present paper, the arguments given are based on misinterpretation of some unconventional and possibly ambiguous aspects of the work. Proof is given below that group theoretical considerations can effectively be used in place of standard commutator techniques. (NL)

16073 LOCAL ENERGY-DEPENDENT IMAGINARY OPTICAL POTENTIAL. Lev, A.; Beres, W. P. (Wayne State Univ., Detroit, Mich. (USA). Dept. of Physics). Phys. Lett., B; 58: No. 3, 263-265(15 Sep 1975).

A simple procedure is presented for obtaining an energy-dependent local imaginary optical potential. The energy dependent strength, for a particular radial form, is obtained from a microscopic theory. The potential can easily be used with standard codes that involve local radial form factors. The case of neutrons on ^{208}Pb is treated as an example. (NL)

16074 THE SCATTERING OF FAST PARTICLES AND THE CLUSTERING PHENOMENA. Sliv, L. A. (Leningrad Nuclear Physics Institute, Gatchina, USSR). Phys. Lett., B; 58: No. 3, 266-268(15 Sep 1975).

A fast particle passing through the nucleus causes a density perturbation $\delta\rho$ (r,t). As a result of such a perturbation volume elastic waves, nuclear plasmons are formed. At the surface these waves disintegrate transmitting the energy mainly to clusters which leave the nucleus. (NL)

16075 EQUATION OF STATE FOR NEUTRON MATTER IN THE PRESENCE OF A PION CONDENSATE. Weise, W.; Brown, G. E. (State Univ. of New York, Stony Brook (USA). Dept. of Physics). Phys. Lett., B; 58: No. 3, 300-305(15 Sep 1975).

The energy density for neutron matter including a pion condensed phase is studied, with particular emphasis on the role of Δ-isobars. Relativistic corrections to vertex functions involving isobars are considered and turn out to be important in the high density region. A simple schematic model is arrived at in which the inclusion of isobars leads to an effective enhancement of the axial vector coupling constant, which competes with an effective reduction due to the Lorentz-Lorenz correction. In the equation of state, inclusion of a pion condensed phase can lead to an appreciable reduction of total pressure. (NL)

16076 A SIMPLE MODEL CALCULATION OF PION CONDENSATION IN NEUTRON MATTER. Baym, G. (Illinois Univ., Urbana (USA). Dept. of Physics); Campbell, D.; Dashen, R. (Los Alamos Scientific Lab., N. Mex. (USA)); Manassah, J. (American Univ., Beirut(Lebanon)). Phys. Lett., B; 58: No. 3, 304-308(15 Sep 1975).

The charged pion-condensed state in pure neutron matter is described analytically in an approximate calculation based on the chirally invariant σ-model. The calculation includes s- and p-wave condensed pion-nucleon interactions, pi-pi interactions, the effect of the N* (1236) resonance, and the (Ericson-Ericson Lorentz-Lorentz) effect of nuclear correlations. (NL)

16077 NEUTRON POLARIZABILITY AND THE DENSE NEUTRON MATTER. Ragusa, S. (Univ., Sao Paulo, Brazil). Lett. Nuovo Cim.; 14: No. 9, 338-340(1 Nov 1975).

The magnetic polarizability of the neutron is estimated using a general expression obtained using gauge and relativistic invariance. The result is $\beta = 9.5 \times 10^{-4}$ fm^3. (SDF)

16078 SOLUTION OF THE EQUATION OF QUADRUPOLE DEFORMATION OF NONAXIAL NUCLEI. Salakhitdinov, A. N.; Sharipov, Sh. (Inst. of Nuclear Physics, Tashkent). Izv. Akad. Nauk Uzb. SSR, Ser. Fiz.-Mat. Nauk; No. 3, 58-62(1975). (In Russian).

The collective motion of a nonaxial even-even nucleus with different types of potential energy of surface oscillations was studied. (tr-auth)

16079 THE CORRELATED BASIS FUNCTION METHOD AND ITS APPLICATION TO LIQUID ^{3}He, NUCLEAR MATTER AND NEUTRON MATTER. Nitsch, J. (Koeln Univ. (F. R. Germany). Inst. fuer Theoretische Physik). Z. Naturforsch., A; 30: No. 8, 923-936(Aug 1975).

5 figs.; 10 tabs.; 43 refs.

The method of correlated basis functions is studied and applied to the Fermi systems: liquid ^{3}He, nuclear matter and neutron matter. The reduced cluster integrals $x_{ijkl\ldots}$ and so the subnormalization integrals $I_{ijkl\ldots}$ are generalized to coinciding quantum numbers out of the set [i, j, k, l, ...]. This generalization has an important consequence for the radial distribution function g(r) (and then for the liquid structure function); g(r) has no contributions of the order $0(A^{-1})$. For ^{3}He the state-independent two-body correlation function f(r) is calculated from the Euler-Lagrange equation (in the limit of $r \to 0$) for the unrenormalized two-body energy functional. For nuclear matter and neutron matter we adopt the three-parameter correlation function of Baeckman et al. Then the energy expectation values are calculated by including up to the three-body terms in the un-renormalized and renormalized version of the correlated basis functions method. (DE)

16080 ALPHA-DECAY – A RESONANT PHENOMENON. Hahn, H. (Bochum Univ. (F. R. Germany). Inst. fuer Theoretische Physik). Z. Phys., A; 274: No. 1, 59-67(Aug 1975). (In German)

3 tabs.; 30 refs.

Assuming exponential decay a new expression for the decay width is derived. A method to obtain the "prepared state" is given. The reduction of the many body to the one body problem is described. The resulting theory is compared with the R-matrix theory. It is applied on α-decay in ^{16}O. (DE)

16081 COLLECTIVE EXCITATIONS OF LIGHT NUCLEI. Filippov, G. F.; Maksimenko, V. N. (Inst. of Theoretical Physics, Kiev). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 3, 26-31(1975).

From 25th all-union conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1975). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 3, 489-495(1975).

Using the method of generalized hyperspherical functions, collective excitations in light nuclei are described. ^{6}He is considered as an example. (SDF)

16082 PECULIARITIES OF THE KINETICS OF RESONANCE γ-RADIATION INTERACTION. Vorontsov, V. I.; Vysotskii, V. I. Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 3, 32-35(1975).

From 25th all-union conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1975). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 3, 496-500(1975).

The problem of considering the influence of the actual inhomogeneous broadening of the contour of a γ-transition line on the peculiarities of the process involving the kinetics of developing γ-wave is discussed. (auth)

16083 STOCHASTIC METHOD OF OPTIMIZING THE BASIS FOR VARIATIONAL CALCULATIONS OF MANY-PARTICLE SYSTEMS. Kukulin, V. I. (Moscow State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 3, 59-65(1975).

From 25th all-union conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1975). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 3, 535-542(1975).

A possible method is proposed for circumventing certain difficulties and radically reducing the dimensions of the variational basis as a result of pronounced acceleration of the convergence of the variational expansions. As an illustration of the method which has been developed, certain results of variational calculations are presented for two- and three-particle systems and are compared with the exact results and the results obtained by other authors. (auth)

16084 VARIATIONAL CALCULATIONS IN THE THREE-BODY PROBLEM ON A STOCHASTICALLY OPTIMIZED BASIS. Krasnopol'skii, V. M.; Kukulin, V. I. (Moscow State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 3, 66-71(1975).

From 25th all-union conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1975). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 3, 543-549(1975).

The results of variational calculations of model three-particle systems obtained using a stochastically optimized nonminimal complete basis are expounded in detail. (4 tables, 5 figures) (auth)

16085 SOME PROPERTIES OF A SOLUTION TO THE LIPPMAN–SCHWINGER EQUATION. Popova, A. M.; Popov, Yu. V. Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 3, 98-101(1975).

From 25th all-union conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1975). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 3, 578-582(1975).

The exact analytical form for the two-particle scattering amplitudes for potentials of rectangular-well type and similar ones has been derived, as well as the approximate form of the amplitude in the more general use. The results on the behavior of the amplitude away from the energy surface can be used in analytical handling of problems for three and four bodies by methods from the theory of functions of a complex variable, and here the form of the two-particle amplitude for scattering at a rectangular well is important. It has also been found possible to perform numerical and analytical calculations for the two-particle amplitude for a fairly broad class of potentials, and on this basis it is possible to describe elastic and inelastic scattering by nuclei. (auth)

16086 QUASIEQUIVALENT POTENTIALS AND AMBIGUITY IN ELASTIC-SCATTERING ANALYSIS. Tokarevskii, V. V. Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 3, 113-119(1975).

From 25th all-union conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1975). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 3, 597-605(1975).

The interaction-potential concept is widely used in interpreting nuclear collisions. The practical use of the potential approach involves the following assumptions: (1) the nonlocal potential is usually replaced by an equivalent potential, which involves the assumption that the parameters in the potential are dependent on the relative energy of the colliding particles, and (2) the interaction potential is the same for all partial waves (one envisages here the spin-independent part of the interaction). The phenomenological problem of finding the potential from the differential cross sections is formulated in this paper. (6 figures, 1 table) (auth)

16087 IMAGINARY PART OF THE OPTICAL POTENTIAL FOR SCATTERING BY ODD NUCLIDES. Zagrebaev, V. I. Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 3, 124-128(1975).

From 25th all-union conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1975). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 3, 611-616(1975).

The coordinate representation of the imaginary part of the optical potential is examined using a semiphenomenological nuclear model. This is used in a method of calculating the imaginary part. The model is discussed, and calculations are presented for the contributions from the one-particle excitations in the odd target nucleus to the imaginary part. Finally, the role of resonance processes in the optical potential is investigated. (auth)

16088 NUCLEAR SHAPE PARAMETERS IN THE MODEL FOR AN EVEN–EVEN NONAXIAL DEFORMED NUCLEUS. Kashuba, I. F.; Kotishevskaya, E. Yu. Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 3, 129-135(1975).

From 25th all-union conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1975). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 3, 617-624(1975).

A model for a nonaxial deformed nucleus in the quadrupole-oscillation approximation is used to calculate the parameters such as the effective nonaxiality, the deformability, and the energy multipliers for even-even nuclides over a wide range in mass number. The parameters are determined by comparing the calculated energy levels with the measured ones for the ground-state rotation band and the γ-vibration band. (auth)

16089 STRUCTURE OF THE NUCLEAR ENERGY SURFACE. Kolesnikov, N. N.; Vymyatnin, V. M. (Moscow State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 3, 147-149(1975).

From 25th all-union conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1975). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 3, 637-640(1975).

The structure of the smoothing formula and shell corrections are determined using experimental data alone rather than model concepts. Parameters are calculated for the binding energy formula for even–even nuclei and are compared with results obtained by other formulae. (SDF)

16090 NUCLEON REMOVAL AND REARRANGEMENT ENERGIES. Hodgson, P. E. (Oxford Univ.). Rep. Prog. Phys.; 38: No. 7, 847-902(Jul 1975).

The process of nucleon removal from a nucleus is analyzed together with the associated nuclear rearrangement. Several possible definitions of the rearrangement energy are reviewed, and their connection with experimentally observable quantities is investigated. (auth)

16091 IS THE NUCLEUS A MANY BODY PROBLEM. Kuemmel, H. (Bochum Univ. (F. R. Germany). Inst. fuer Theoretische Physik). pp 133-152 of Mesonic Effects in Nuclear Structure. Proceedings. Bleuler, K. (ed.). Mannheim, F. R. Germany; Bibliographisches Institut (1975).

From symposium on mesonic effects in nuclear structure in remembrance of K. Erkelenz; Bonn, F. R. Germany (29 Jan 1974). 6 figs.; 2 tabs.; 16 refs.

A review is given of the present status of the many-body theory as applied to ground states of double-magic nuclei. The systematics of the theory beyond the BHF approximation is described. Inclusion of three-particle Bethe-Faddeev terms reduces the errors to a few per cent, a conclusion supported by comparison with the "exact" calculations of the hyperspherical theory. The remaining discrepancy of about 10% between theory and experiment therefore cannot be explained within the "classical" many-body theory and must be due to mesonic effects. (DE)

16092 EFFECTIVE DYNAMIC INTERACTION FOR THE TWO-PARTICLE PROPAGATOR. Hahne, F. J. W.; Heiss, W. D. (Atomic Energy Board, Pelindaba, Pretoria (South Africa)). Z. Phys., A; 273: No. 3, 269-276(Jul 1975).

3 figs.; 26 refs.

In nuclear structure calculations the collective excitations of the core introduce dynamic effects in the interaction between particles. Under the restriction of including forward-going contributions only, it is shown that the two-particle propagator which yields the spectra and two-particle transfer strengths of nuclei with two nucleons outside a closed shell, can be written in a Dyson-like equation in which a two-particle self-energy or dynamic effective interaction Λ is introduced. An expression for Λ is given in terms of the irreducible vertex part of the Bethe-Salpeter equation, and partial summations for Λ using phonon exchange interactions to represent the core-polarization diagrams are discussed. The single-particle propagators are also dressed with phonon-exchange contributions. (DE)

16093 EXTENSION OF BRUECKNER THEORY TO INCLUDE MESONIC DEGREES OF FREEDOM. Schuette, D. (Bonn Univ. (F. R. Germany). Inst. fuer Theoretische Kernphysik). pp 170-181 of Mesonic Effects in Nuclear Structure. Proceedings. Bleuler, K. (ed.). Mannheim, F. R. Germany; Bibliographisches Institut (1975).

From symposium on mesonic effects in nuclear structure in remembrance of K. Erkelenz; Bonn, F. R. Germany (29 Jan 1974). 3 figs.; 24 refs.

The effects of mesonic degrees of freedom on the N-N scattering and on the binding energy problem of nuclear matter are investigated. This is done by extending the standard many body perturbation theory to a field theoretical Hamiltonian. Only diagrams of One Boson Exchange (OBE) type are taken into account. The resulting scheme contains meson current corrections which are physically interpreted. The relation to standard many body theory is established. Some numerical results are presented and discussed. (DE)

16094 MESONIC EXCHANGE CONTRIBUTIONS TO NUCLEAR PHOTO REACTIONS. Gari, M. (Bochum Univ. (F. R. Germany). Inst. fuer Theoretische Physik). pp 153-169 of Mesonic Effects in Nuclear Structure. Proceedings. Bleuler, K. (ed.). Mannheim, F. R. Germany; Bibliographisches Institut (1975).

From symposium on mesonic effects in nuclear structure in remembrance of K. Erkelenz; Bonn, F. R. Germany (29 Jan 1974). 3 figs.; 6 refs.

The importance of mesonic effects in processes like (γ,n), (γ,p), (γ,pn), (γ,pp) and (γ,nn) is discussed. The description of these reactions in the shell model, as well as in extended shell models (Jastrow-, Brueckner- Goldstone-correlations), has not been satisfactory. It is shown that a systematic treatment of the exchange currents, in the simplest approach, is able to explain the standing discrepancy between experiment and pure shell model. The reason for the simular behavior of the reactions (γ,p) and (γ,n) is explained, as well as the suppression of the reactions (γ,pp) and (γ,nn) relative to (γ,pn). Numerical examples are given in the case of ^{4}He for the reactions (γ,p) and (γ,n). (DE)

16095 BLACK SPHERE MODEL FOR THE ABSORPTION OF NEGATIVE HADRONS BY NUCLEI. Pilkuhn, H. (Karlsruhe Univ. (TH) (F. R. Germany). Inst. fuer Theoretische Kernphysik). Z. Phys., A; 273: No. 3, 259-264(Jul 1975).

1 fig.; 2 tabs.; 21 refs.

The slowing down of hadrons in a moderator entails an intensity loss by nuclear absorption. The loss is expected to be particularly large for negative hadrons, due to a combination of Coulomb attraction and strong local absorption. A black sphere absorption model is set up and used for numerical calculations of absorption probability per momentum loss. For K^- and $\bar{p}$ on heavy nuclei, a sharp maximum is found for kinetic energies below 0.1 MeV. (DE)

16096 DEVELOPMENT OF THE MODEL DESCRIBING HIGHLY EXCITED STATES OF THE ODD DEFORMED NUCLEI. Malov, L. A.; Solov'ev, V. G. (Joint Inst. of Nuclear Research, Dubna, USSR). Teor. Mat. Fiz.; 25: No. 2, 265-269(Nov 1975). (In Russian).

An approximate method is given for solving the system of equations which were obtained earlier for describing the structure of states with intermediate and high energies in the framework of the model taking into account the interaction of quasiparticles with phonons. The new method possesses a number of advantages over that worked out earlier for approximate methods of solving the system of equations mentioned. The study is performed for the example of odd deformed nuclei when several one-quasiparticle components are taken into account at the same time. (auth)

16097 QUASIPARTICLE POLE STRENGTH IN NUCLEAR MATTER. Poggioli, R.S. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742); Jackson, A.D. Phys. Rev. Lett. 35: No. 18, 1211-1213 (3 Nov 1975).

It is argued that single-particle-like behavior in nuclear matter is much less probable than Brueckner theory suggests. In particular, the

quasiparticle pole strength is evaluated for nuclear matter and it is shown that, contrary to the spirit of Brueckner theory, low-momentum states play a crucial role in determining the magnitude of z_{k_F}. (auth)

16098 SHADOWING IN INCLUSIVE REACTIONS ON COMPOSITE SYSTEMS AND LARGE-$p_\perp$ INCLUSIVE REACTIONS IN NUCLEI. Fishbane, P.M.; Trefil, J.S. (Department of Physics, University of Virginia, Charlottesville, Virginia 22901). Phys. Rev. D 12: No. 7, 2113-2119 (1 Oct 1975).

We show that there are no shadowing corrections to certain types of inclusive reactions in nuclei, in the sense that the results one finds when shadowing corrections are applied are the same as if no corrections are applied. Among these processes is production of particles at fixed angle. We suggest that this process should have a linear A dependence at large transverse momentum, in contradiction with experimental data. We discuss possible resolutions of this difference, and find we cannot explain it in a natural way, suggesting this process may harbor even more interesting new physics than it has already revealed. We also mention a possible linear A dependence for the production of high-mass dileptons on nuclei. (auth)

16099 PRESENT STATUS OF THE TREATMENT OF RECOIL AND FINITE-RANGE EFFECTS IN HEAVY-ION TRANSFER REACTIONS. Elbaz, E. (Univ. Claude Bernard, Lyon). Riv. Nuovo Cim.; 5: No. 4, 561-592(1975).

The review of the present status of the treatment of recoil and finite-range effects in heavy-ion transfer reactions includes the different possible expansions of a function of a sum of two vectors, and then the general formalism for the heavy-ion transfer reaction. The no-recoil approximation and different possible simplifications are treated. The different approximate and exact treatments of the recoil and finite-range effects are reviewed. The graphical treatment of the angular-momentum algebra is extensively used, and when possible it is shown what results yielded the considered method. (JFP)

16100 DOORWAY-STATE DESCRIPTION OF FISSION INTERMEDIATE STRUCTURE. Vitturi, A. (Univ., Padua); Zardi, F. Riv. Nuovo Cim.; 5: No. 4, 648-684(1975).

A rigorous and self-contained theoretical framework for the analysis of data on the doorway description of fission intermediate structure is given. The review is based on the Lane-Robson theory of intermediate structure in its Kapur-Peierls representation. The unifying power of this approach is shown, which enables one to describe the many facets of a doorway-state phenomenon by the proper particularization of unique basic formula. (JFP)

PHYSICS (RADIATION AND SHIELDING)

16101 (AEC-tr-7315, pp 52-56) ATTENUATION OF A COLLIMATED SLOW NEUTRON BEAM BY PLANE: PARALLEL BARRIERS. Ponomarev, E. G.; Tyufyakov, N. D.; Shtan, A. S.; Yaskevish, V. S. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

In the nondestructive control of the quality of materials and articles by the neutron radiography method, the sensitivity of appearance of defects and the range of material thicknesses, accessible for control, depends, for the same conditions, on the character of the spreading of the slow neutron beam through the transilluminated object. Such data are necessary for the choice of the neutron source, plotting of the exposure nomogram, determination of the scattered neutron flux, evaluation of the magnitude of the background radiation accompanying the spreading of slow neutrons in the matter, etc. Some of the indicated characteristics, as applied to neutron radiography, can be determined if the transmission coefficients of the collimated neutron beam by the investigated materials are known. These coefficients were determined experimentally in the present work. The measurements were carried out using plane-parallel discs of lead, uranium, tungsten (alloy VNM-2-3), plastic, and steel. The dimensions of the discs were 100 x 100 mm in case of uranium and tungsten, and 300 x 300 mm in case of the other materials. (auth)

Radiation Physics

Refer also to abstracts 15549, 15552, 15564, 15912, 15920, and 16124.

16102 (AEC-tr-7315, pp 82-87) SIMULATION OF ABSORBING MEDIA IN THE USE OF gamma-RADIATION SOURCES. Mashinin, V. A.; Popov, A. A.; Schelokov, S. P. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

In radioisotope instrument manufacturing, the finishing stages often require testing with natural media that can be corrosive, inflammable, toxic, or otherwise dangerous to handle. Expressions are derived to enable the simulation of natural media by the combination of three components with known characteristics. The radiation field in the simulator material due to gamma radiation can be made nearly identical to the field in the natural material. (GHT)

16103 (ORNL-TM-5188) INELASTIC INTERACTIONS OF SWIFT ELECTRONS IN SOLIDS. Tung, C. J.; Ritchie, R. H.; Ashley, J. C.; Anderson, V. E. (Oak Ridge National Lab., Tenn. (USA)). Jan 1976. Contract W-7405-eng-26. 120p. Dep. NTIS $7.00.

Thesis. Submitted by C. J. Tung to the Graduate School of the Univ. of Tennessee, Knoxville.

Theoretical calculations of electron mean free paths and electron slowing-down spectra in solids are described. These calculations involve (a) the use of an electron gas model to approximate the response of conduction band electrons in metals, (b) the application of a statistical model for the calculation of electron mean free paths in metals, (c) the development of an insulator model to describe valence band electrons in insulators and semiconductors, and (d) the use of data on atomic generalized oscillator strengths to describe the excitation of the ion cores. Exchange effects are included in the calculations through a semi-empirical procedure. Detailed results are presented for electron mean free paths in Ag, Au, Al, and Al_2O_3, and on the stopping power of Al and Al_2O_3, for electrons with energies at a few eV to 10 keV. The agreement of these calculations with experimental measurements is quite reasonable over a wide range of electron energies. A detailed description of the calculation of electron slowing-down spectra in solids is presented. Low energy electron slowing-down spectra of monoenergetic electron sources in Al and Al_2O_3 are calculated. Calculations of electron slowing-down spectra in Al_2O_3 are made using differential cross sections obtained employing an insulator model and from GOS functions for ion core electrons. Auger electron contributions to the slowing-down spectrum are discussed. Results for the slowing-down spectrum are compared with the experimental data measured by Birkhoff and coworkers. Generally good agreement is found over a wide range of electron energies. (auth)

16104 (UCRL-77202) ELECTRON BEAM ENERGY DEPOSITION AND VUV EFFICIENCY MEASUREMENTS IN RARE GASES. Turner, C. E. Jr.; Hoff, P. W.; Taska, J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Nov 1975. 25p. (CONF-751108-18). Dep. NTIS $4.25.

From 1st international topical conference on electron beam research and technology; Albuquerque, New Mexico, USA (3 Nov 1975).

Reliable techniques for the determination of the energy/cm^3 deposited by an e-beam into a gas as well as the energy/cm^3 radiated have been developed in order to obtain dependable data on the VUV fluorescence efficiency for rare gas excimers. Spatially resolved total stopping calorimetry in the gas at the cell foil was used to characterize the energy distribution in the e-beam (approximately 200 kV, few Amp/cm^2, approximately 1 mu sec) transmitted by a "hibachi"-supported 1-mil Ti foil. By using these data, suitable input for a 3-D Monte Carlo electron transport code (SANDYL) was generated. The spatial distribution of energy deposition in the gas was then calculated taking into account multiple scattering and cell geometry. The validity of the SANDYL technique is substantiated by excellent agreement between the measured and calculated energy flux on a vertical stack of five fast risetime (less than 1 msec) calorimeters at several depth positions [0 less than Z(cm) less than 15] in the gas [1 less than P(atm) less than 3]. Calibrated optical components were used in a well defined geometry that permitted calculation of the effective radiating volume observed. By using the above techniques, high absolute efficiencies (10–30 percent) have been measured for rare gas VUV continua emission which can photolytically produce group VI metastables [e.g., $O(^1S)$, $S(^1S)$] of interest as fusion visible-laser candidates.

16105 LOWERING THE BREAKDOWN VOLTAGE OF A GAS IN A FIELD OF STEADY-STATE, IONIZING RADIATION. Dantser, A. A.; Feoktistov, V. A. Zh. Prikl. Mekh. Tekh. Fiz.; No. 3, 26-31(1975). (In Russian).

A numerical solution is presented to the problem of lowering the electrical strength of a gas which exists in a field of external, steady-state ionizing radiation. Volt-ampere characteristics were calculated for argon at various pressures and gap distances. Paschen curves were calculated for helium, argon, and xenon. the calculation was carried by means of a method of making adjustments with the use of a standard Runge-Kutta program. (tr-auth)

16106 ELECTROMAGNETIC FIELD EXCITED IN AIR BY A NON-STEADY-STATE SOURCE OF γ RADIATION, LOCATED ON AN IDEALLY CONDUCTING PLANE. Vilenskaya, G. G.; Imshennik, V. S.; Medvedev, Yu. A.; Stepanov, B. M.; Feoktistov, L. P. Zh. Prikl. Mekh. Tekh. Fiz.; No. 3, 18-26(1975). (In Russian).

A look is taken at modeling the problem of exciting a radio-signal by a non-steady-state source of γ radiation. The problem which is substantially two-dimension in space is reduced by the method of mirror transformations to a series of one-dimensional, non-steady-state problems. The results of the numerical solution of the problem are discussed. (tr-auth)

16107 A GENERALIZED EMPIRICAL EQUATION FOR THE TRANSMISSION COEFFICIENT OF ELECTRONS. Tabata, T.; Ito, R. (Radiation Center of Osaka Prefecture, Sakai (Japan)). Nucl. Instrum. Methods; 127: No. 3, 429-434(15 Aug 1975).

An empirical equation for the transmission coefficient of monoenergetic electrons normally incident on the absorber has been formulated by modifying the expression proposed by Rao. It utilizes a semiempirical equation recently developed for the extrapolated range of electrons, and the dependence of a single remaining parameter upon the incident energy T_0 and the atomic number Z of the absorber has been determined by using a total of 79 experimental transmission curves for T_0 = 8 keV–30 MeV and for Z = 4–82. The rms absolute error of the equation is about 0.03 in most cases. (NL)

16108 PERTURBATION THEORY FOR CHARGED-PARTICLE TRANSPORT IN ONE DIMENSION. Wilson, J. W. (Langley Research Center, Hampton, VA); Lambkin, S. L. Nucl. Sci. Eng.; 57: No. 4, 292-299(Aug 1975).

Perturbation theory, when applied to charged-particle transport, generates a series solution that requires a double quadrature per term. The continuity of higher-order terms leads to numerical evaluation of the series. The high rate of convergence of the series makes the method a practical tool for charged-particle transport problems. The coupling of the neutron component in the case of proton transport in tissue does not greatly alter the rate of convergence. The method holds promise for a practical high-energy proton transport theory. (auth)

16109 DEEP PENETRATION OF POLONIUM IMPLANTED IN CADMIUM SULFIDE. Weinmann, E. Boulder, CO; Univ. of Colorado (1975). 221p. University Microfilms Order No. 75-23,596.

Thesis (Ph. D.).

The distribution of 25 keV ^{210}Po implanted into CdS platelets was determined by means of energy analysis of the alpha-particles emitted by the ^{210}Po. Two samples were implanted along an axial channeling direction, and one along a planar channeling direction. The resulting distributions did not conform to any of the existing range theories or, in the case of axial channeling, to existing diffusion theories. A new diffusion model was formulated and fitted to the experimental data. Good agreement was obtained between this model and experiment for both the axial and the planar channeling conditions. The stopping power of CdS for He ions was measured as a preliminary step to the Po distribution measurement. A new technique was used which consisted in measuring the energy spectrum of either He ions backscattered from Bi implanted in CdS or of alpha-particles emitted by ^{210}Po implanted in CdS. A thin layer was then etched off the surface of the sample and the energy spectrum was measured again. The stopping power was calculated from these two spectra and the known thickness of the removed layer. These measurements and calculations were made for energies ranging from 0.963 to 5.3 MeV with accuracies between 12 percent and 16 percent. (Diss. Abstr. Int., B)

16110 ENERGY LOSS OF LOW-ENERGY CALCIUM IONS IN CARBON. Shane, K. C. Manhattan, KS; Kansas State Univ. (1975). 102p. University Microfilms Order No. 75-16,968.

Thesis (Ph. D.).

Theoretical estimates of the stopping power in carbon of calcium ions of less than 350 keV energy have been tested by an experiment which uses doppler-shifted gamma rays emitted by the calcium ions to infer the energy lost by them in thin carbon foils. The results indicate that these estimates are too large, and that the discrepancy increases as the ion's kinetic energy decreases, in qualitative confirmation of the results of independent measurements. Implications for the theory, which is based on the Thomas-Fermi model of the atom, are discussed. (Diss. Abstr. Int., B)

16111 MEASUREMENTS OF MULTIPLE SCATTERING, RANGE, AND RANGE STRAGGLING OF LOW ENERGY PIONS AND MUONS. Lagerlund, T. D. Blacksburg, VA; Virginia Polytechnic Inst. and State Univ. (1975). 334p. University Microfilms Order No. 75-23,704.

Thesis (Ph. D.).

Using a stack of multiwire proportional chambers with interspersed absorbers, the ranges and directions of low energy pions and muons have been measured. By simultaneously determining both the directions of negative muons incident upon and scattered from thin sheets of galvanized steel, aluminum, and polyethylene, and the ranges of these muons in the proportional chamber stack, their multiple scattering as a function of energy has been obtained. The measured rms projected multiple scattering angle was fitted to a linear function of the values predicted by the Moliere theory. Also the range distributions of positive muons and positive and negative pions at various energies were measured, and the mean range and range straggling (deviation about the mean) were obtained and compared with the calculations of Janni. The percent differences between the actual incident energies (measured in a magnetic spectrometer) and those calculated from the mean range were determined. These results are all within the expected accuracy of the range calculations. The ratios of the observed to the predicted range straggling for the corresponding particles and energies were 1.00, 1.20, 1.40, 1.40, and 1.20. The straggling of pions may appear to be 20 to 40 percent larger than range theory predicts perhaps because of the effects of the strong interactions of pions with the nuclei of atoms in the stopping material. (Diss. Abstr. Int., B)

16112 HIGH ENERGY GAMMA-RAY ENERGY DEPOSITION WITHIN SHIELDING MATERIALS. Van Prooyen, J. A. Charlottesville, VA; Univ. of Virginia (1974). 263p. University Microfilms Order No. 75-22,135.

Thesis (Ph. D.).

Arrays of thermoluminescent dosimeters were used to determine spatial dose distributions from a 0.375 inch diameter beam of essentially monoenergetic high energy gamma rays normally impingent on water, aluminum, and lead phantoms. Photon energies considered were 1.25, 6, and 8 MeV. A conventional Monte Carlo program was used to predict the spatial- and energy-dependent gamma-ray flux in the phantom, and thus to provide a basis for determining average dosimeter response functions at various locations in the phantoms. The experimentally determined dose distributions were compared to the Monte Carlo results and discrepancies were apparent in several cases. At high energies in water and aluminum, considerably more energy was removed from the beam volume than was predicted. This is attributed to the finite range of the energetic secondary electrons which was not considered in the Monte Carlo code. At 6 and 8 MeV, the energy deposition in lead was found to be considerably greater than that predicted. In this case measured off-beam absorption was up to an order of magnitude greater than the Monte Carlo predictions. This behavior is considered to be a result of reradiation and subsequent reabsorption further removed from the initial beam. These results reaffirm the necessity for considering secondary electron transport mechanisms, particularly in the high-Z, high photon energy case. Failure to include these effects in complex source-shield-receptor geometries could lead to serious discrepancies between calculated and measured energy absorption rates. (Diss. Abstr. Int., B)

16113 MONTE CARLO SIMULATION OF ELECTRON BEAM SCATTERING AND ENERGY LOSS IN THIN FILMS ON THICK SUBSTRATES. Kyser, D. F.; Murata, K. (IBM Research Lab., San Jose, CA). pp 205-223 of Electron and Ion Beam Science and Technology. Bakish, R. (ed.). Princeton, NJ; Electrochemical Society, Inc. (1974).

From 6th international conference on electron and ion beam science and technology; San Francisco, California, USA (12 May 1974). See CONF-740515-.

Three-dimensional spatial contours of equi-energy density (eV/cm^3) deposited by an electron beam in a thin film-thick substrate configuration have been calculated with Monte Carlo computer methods. These contours are thought to control the geometry of electron beam resist patterns. Point, line and plane source electron beams are simulated. Lateral scattering and energy loss, within the film, of electrons backscattered from the substrate is included. Comparison of this Monte Carlo calculation is made with other simulation models and the limited experimental data available. (auth)

16114 PHOTOLUMINESCENCE AND CHANNELING STUDY ON ANNEALING BEHAVIOR OF Te ION-IMPLANTED GaAs. Lin, M. S.; Gamo, K.; Masuda, K.; Namba, S. (Osaka Univ., Toyonaka, Japan). pp 226-240 of Electron and Ion Beam Science and Technology. Bakish, R. (ed.). Princeton, NJ; Electrochemical Society, Inc. (1974).

From 6th international conference on electron and ion beam science and technology; San Francisco, California, USA (12 May 1974). See CONF-740515-.

70-keV Te ions were implanted in GaAs single crystals at and above room temperature up to 550^{0}C and annealing behavior of defects and depth distribution was investigated by photoluminescence measurements. Besides the band edge emission, emissions at 9140 and 9900-10200A were observed after implantation and annealing at 800^{0}C. The emission at 9140A was observed even after a removal of approximately 10mu from the surface. This emission is attributed to the As vacancy or the vacancy associated complex from heat treatment study at various temperature. It was found that As vacancies were released during annealing from the damaged region produced by the implantation. The emission at 9900 and 10200A was observed only near the surface when an amorphous or almost amorphous layer was formed by the implantation. No recovery of the edge emission was observed for amorphized samples after annealing at 800^{0}C. It was concluded that the formation of an amorphous layer should be avoided to obtain an efficient band edge emission. (auth)

16115 WIDELY APPLICABLE METHOD FOR COMPUTING DOSE DISTRIBUTIONS FROM EXTERNAL MEGAVOLTAGE BEAMS. Thomas, R. L.; Haybittle, J. L. (Addenbrook's Hospital, Cambridge, Eng.). Br. J. Radiol.; 48: No. 573, 749-754 (Sep 1975).

A method of computing megavoltage dose distributions using an empirical mathematical model is described. The dose at a point in a medium is calculated as the product of a central axis percentage depth dose, a crossplot factor and a wedge factor. For a given set of conditions (i.e., type of machine, source-skin distance and wedge) 16 parameters are required to calculate the values of the three factors and hence the dose at any point. These parameters can be obtained from a relatively small number of experimental measurements. Dose distributions from a variety of different treatment machines have been computed by the method and some comparisons of the calculated and measured doses have been made using "Goodness of Fit" score values. These showed that the use of the method as a basis for computer treatment planning should be clinically acceptable. (auth)

16116 EMPIRICAL EQUATIONS FOR THE REPRESENTATION OF DEPTH DOSE DATA FOR COMPUTERIZED TREATMENT PLANNING. Kornelsen, R. O.; Young, M.E.J. (British Columbia Cancer Inst., Vancouver). Br. J. Radiol.; 48: No. 573, 739-748 (Sep 1975).

Equations of the form $P = 100\ (1 - (1 - \exp(-d/Q))^M)$ and $TAR = S\ (1 - (1 - \exp(-d/Q))^M)$ have been used to represent the variation of central axis percentage depth dose P or tissue-air ratio (TAR) with depth d below the dose maximum. These equations were originally developed for the representation of cobalt 60 depth dose data but have also been fitted to the central axis depth dose data published in the British Journal of Radiology Supplement 11, for radiations ranging in energy from 1·5 mm Cu HVT to 8 MV. Values of the constants Q and M for standard field sizes are presented together with an estimate of the goodness of fit in each case. Two different approaches have been used in determining the dose at points other than those on the central axis. In the simpler method, used for rotation techniques, the off-axis ratio (OAR) was calculated from the equation: $OAR = k_1 + (1 - k_1)[1/(1 + \exp(k_2(x - 0.5w)))]$ where x is the off-axis distance, w the field width at the depth and k_1 and k_2 are constants. In the more accurate method, used for fixed field techniques, different equations were used within the main beam, within the geometrical penumbra and outside the beam. (auth)

16117 ALPHA PARTICLE RANGE AND X-RAY ABSORPTION MEASUREMENTS ON THIN FOILS. Carlton, R. F.; Welch, A. H. Jr. (Middle Tennessee State Univ., Murfreesboro). J. Tenn. Acad. Sci.; 48: No. 4, 137-138 (Oct 1973).

Alpha particles from ^{241}Am and x-rays from ^{57}Co have been used in range and absorption studies using thin copper foils. The theory and advantages of the two methods in measuring foil thicknesses are discussed, as well as the data analysis. The photoelectric cross section of copper at a photon energy of 15 keV has been obtained from the analysis of the x-ray data. Such a study, incorporated in an undergraduate laboratory, may serve to elucidate the fundamental difference of the interaction processes involved. (auth)

16118 MONTE CARLO SIMULATION OF SPATIALLY DISTRIBUTED BEAMS IN ELECTRON-BEAM LITHOGRAPHY. Kyser, D.F. (IBM Research Division, San Jose, California 95193); Viswanathan, N.S. J. Vac. Sci. Technol. 12: No. 6, 1305-1308 (Nov 1975).

The spatial distribution of energy deposited in a thin polymer film of polymethyl methacrylate (PMMA) by a laterally distributed electron beam is simulated with Monte Carlo calculations. The Monte Carlo simulation includes the significant contribution from electrons that are backscattered from the substrate (Si) into the film. Equienergy density contours (eV/cm^3) are calculated for specific cases of beam voltage, film thickness, beam width, and beam-edge slope. A time-dependent solubility model is also incorporated to simulate the time evolution of the developed contours. A size effect is observed; i.e., the development time for a line depends on the line width. This intraproximity effect is ascribed to electrons backscattered from the substrate. (auth)

16119 RANGE, DISTRIBUTION, AND STOPPING POWER OF 800-keV $^{14}N^+$ IONS IMPLANTED IN METALS FROM $Z_2 = 22$ TO $Z_2 = 32$. Simons, D.G.; Land, D.J.; Brennan, J.G.; Brown, M.D. (Naval Surface Weapons Center, White Oak, Silver Spring, Maryland 20910). Phys. Rev. A 12: No. 6, 2383-2392 (Dec 1975).

Concentration distributions of 800-keV $^{14}N^+$ ions implanted in metallic targets from titanium ($Z_2 = 22$) through germanium ($Z_2 = 32$) were determined from γ-ray-yield distributions using the $^{14}N(p, \gamma)^{15}O$ resonance reaction at 1061.0 keV. Comparison of the first and second moments of these distributions with those predicted by the theory of Lindhard, Scharff, and Schiott (LSS) shows that the measured distributions are generally shallower and narrower. In addition, the measured distributions are strongly skewed such that their concentrations fall off more rapidly for deeper target layers. Values for the third moment of these distributions are also presented. We have attributed the discrepancies between the measured and predicted distributions to the behavior of the electronic stopping power, S_e. Values of S_e for the targets studied here were determined by altering the LSS value of S_e for each target by a multiplicative constant such that the predicted projected range is equal to the first moment of the measured distribution. With this adjustment, the predicted range straggling agrees closely with the measured second moments. The adjusted values of S_e exhibit a Z_2 dependence which is not accounted for in either the LSS or Firsov pictures of electronic stopping power. Increases in the LSS values by as much as 60% are needed to describe the measured distributions. The Z_2 dependence of S_e observed here suggests that there is an oscillatory behavior similar to the Z_1 dependence previously reported by Ormrod, MacDonald, and Duckworth, and by Hvelplund and Fastrup. (auth)

Radiation Protection Standards

Refer also to abstract 16125.

16120 (COM-75-50166) GENERAL SAFETY STANDARD FOR INSTALLATIONS USING NON-MEDICAL X-RAY AND SEALED γ-RAY SOURCES, ENERGIES UP TO 10 MeV. American National Standard. Eisenhower, E. H. (American National Standards Inst., New York). Feb 1975. 70p. GPO.

Revision of rept. No. Z54.1-1963, pub. as NBS-H-93.

The standard establishes requirements for the design and operation of common types of installations which use γ and x radiation for non-medical purposes. Its objective is to protect persons who work with or are near such installations, as well as the general public, against, excessive exposure to radiation. Maximum permissible dose limits established by the National Council on Radiation Protection and Measurements are cited. Methods for achieving adequate radiation protection are described, including structural details, surveys and inspections, and operating procedures. Appendixes contain technical information useful for design of radiation shielding barriers. (GRA)

Radiation Source Calibration and Standardization

16121 (AEC-tr-7315, pp 48-51) MEASUREMENT OF THE SPECTRO-ANGULAR CHARACTERISTICS OF THE beta-SOURCES BIS-10. Kumirov, A. L.; Terent'ev, B. M. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

The results of measurements of the spectro-angular and other characteristics of the sources BIS-10 of 1-10m Curie activity are presented. Comparison is made to the measured spectrum of a thin ^{90}Sr-^{90}Y source. 2 figures. (GHT)

16122 (ORNL-TM-5176) SURVEY OF SHIELDING SENSITIVITY ANALYSIS DEVELOPMENT AND APPLICATIONS PROGRAM AT ORNL. Oblow, E. M. (Oak Ridge National Lab., Tenn. (USA)). Jan 1976. Contract W-7405-eng-26. 53p. (CONF-751063-2). AT.

From specialists' meeting on sensitivity studies and shielding benchmarks; Paris, France (7 Oct 1975).

The cross-section sensitivity analysis program at ORNL is reviewed with emphasis on present computer code capabilities and past successful applications in the radiation shielding area. The FORSS sensitivity code system is discussed in regard to objectives, methodology, and code specifications. Examples of past shielding applications of FORSS emphasize the success of fine energy grid sensitivity studies and group structure selection, the use of evalusted error files in problem uncertainty estimation, two-dimensional shield sensitivity analysis and integral experiment design for fast reactors, data studies for the LMFBR program related to sodium and iron evaluations, and iron data problems in CTR shield design. Conclusions are drawn about the adequacy of present ENDF/B data files for sodium and iron and the general applicability of sensitivity studies in future shield design and analysis. (auth)

Shielding Calculations and Experiments

Refer also to abstracts 14354, 15918, and 16108.

16123 (AEC-tr-7315, pp 13-22) RADIATION SHIELDING OF ENERGY GENERATORS BASED ON beta- AND gamma-EMITTING ISOTOPES. Zharkov, V. A.; Rodionov, Yu. A.; Filatov, L. A. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

Some problems of the radiation shielding of generators with isotope blocks, based on beta-emitters accompanied with gamma or bremsstrahlung radiation (^{60}Co, ^{137}Cs, ^{90}Sr, etc.), are investigated. Calculations of shielding to optimize both weight and dimensions of the final shield are given. 3 figs., 1 table. (GHT)

16124 (AEC-tr-7315, pp 88-100) PROBLEM OF THE FORM OF THE CURVE OF ATTENUATION OF A beta-RADIATION FLUX IN MATTER. Kukharenko, I. V.; Mashinin, V. A.; Salakhov, A. M.; Shipulina, L. A. 1971. Translated from Radiats. Tekh.; No. 6, (1971).

In Radiation Technology, Issue 6.

An expression is derived which enables calculation of the multiplicity of attenuation of a flux of beta-particles that has passed through an absorber. Comparison of calculated values and experimental values is made. 7 figs, 3 tables (GHT)

16125 ABSCHIRMWAENDE GEGEN IONISIERENDE STRAHLUNG. Bleibausteine; Hinweise fuer die Verwendung. (Walls Shielding Against Ionizing Radiation. Lead Bricks; Recommen-

dations for Use). Berlin, F. R. Germany; Beuth (Feb 1974). 4p. (In German). (DIN-25407(B1.1Beibl.)).

1 tab.; 11 refs.; with figs.

These specifications are to help the users of lead bricks as under DIN 25407, leaf 1, with the construction of walls shielding against ionizing radiation by examples for the uses of the different types of lead bricks and by recommendations for the construction of shielding walls and for the determination of the wall thickness necessary for shielding against γ-radiation as a function of energy. (DE)

PHYSICS (THEORETICAL)

General

Refer also to abstracts 15768 and 16079.

16126 (BNWL-SA-5582) MATHEMATICAL FOUNDATION WORKSHOP V-STATISTICS OF MEASUREMENT. Nicholson, W. L. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. Contract E(45-1)-1830. 3p. (CONF-750986-1). Dep. NTIS $4.50.

From 4th international congress of the Society for Stereology; Washington, District of Columbia, USA (4 Sep 1975).

The discussion of the statistics of measurement includes the required number of measurements and the precision of the estimate. Basic stereological relations describe global or average value geometric properties of the three-dimensional structure. Actual measurements are distributed about such a global property. The precision of such a global property estimate depends upon the method of taking measurements and the complexity of the structure as well as the number of measurements. If the structure is spatially heterogeneous, precision is highly dependent on the sampling plan used to select the sections for examination. (JFP)

16127 (ITP-75-57R) GROUND STATE OF MANY-BOSON MODEL SYSTEMS. II. A System of Charged Bosons. Vakarchuk, I. A. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1975. 27p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The ground state of the charged bosons is investigated by means of the pair distribution function of many bosons calculated previously. An effective potential and its exact asymptotic expressions for long and short distances are calculated. An effective interaction is constant for short distances, for long distances it oscillates and decreases by the exponent law. The ground state energy as the function of the nonideality parameters is calculated. All the calculations are reduced to the number analytically and for energy the series expansion in powers $\mu_s^{3/4}$ is obtained for the case of the weak coupling $\mu_s \to 0$. For large values of the parameter μ_s the energy is calculated by means of the numerical integration. (auth)

16128 MULTIPOLES IN CYLINDRICAL COORDINATES. McMillan, E. M. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Nucl. Instrum. Methods; 127: No. 3, 471-474 (15 Aug 1975).

Solutions of Laplace's equation for azimuthally symmetrical potentials in cylindrical coordinates are found which can be correlated with two-dimensional multipoles in planes theta equals const. Formulas are presented by which the coefficients for linear combinations of these solutions can be calculated to describe fields whose values are known along given axial or radial lines. (NL)

16129 HARMONIC APPROXIMATION OF THE FUNCTIONAL INTEGRAL AND THE SCHROEDINGER EQUATION. Fano, G.; Turchetti, G. (Bologna Univ. (Italy). Istituto di Fisica). Phys. Lett., B; 58: No. 3, 341-344(15 Sep 1975).

A new approximation for the density matrix $e^{-\beta H}(x,y)$ of a quantum-mechanical system is proposed. Starting from the Feynman-Kac formula the potential is expanded up to second order around the linear path connecting x and y. As an example the first eigenvalues of the anharmonic oscillator are computed. The analogue procedure in field theory is briefly discussed. (NL)

16130 OFF-SHELL t-MATRIX FOR AN EXPONENTIAL POTENTIAL WITH NON-LOCAL CORE INTERACTION. Sarkar, S. B.; Talukdar, B.; Chattarji, D. (Visvabharati Univ., Santiniketan (India). Dept. of Physics). Nucl. Phys., A; 250: No. 1, 73-78(29 Sep 1975).

The wave function approach of Van Leewan and Reiner to the t-matrix is generalized to the case of a non-local potential. The transition matrix element for this potential is obtained. The results are used to compute the s-wave part of the t-matrix for a non-local square well potential combined with an outside exponential potential. (NL)

16131 COUPLED CHANNEL T-OPERATOR EQUATIONS WITH CONNECTED KERNELS. I. Three-Body Problem with Pairwise Interactions. Kouri, D. J. (Max-Planck-Institut fuer Stroemungsforschung, Goettingen (F. R. Germany)); Levin, F. S. (Brown Univ., Providence, R. I. (USA). Dept. of Physics). Nucl. Phys., A; 250: No. 1, 127-140(29 Sep 1975).

Previous work on T-operator coupled equations for two-channel systems is generalized and applied to the problem of three bodies interacting via pair potentials. Sets of coupled, integral equations for the two-body arrangement channel T-operators are derived using a channel coupling array W, and the connectedness properties of the kernels of these equations are discussed. It is shown that either disconnected or connected (iterated) kernels can be obtained by various choices of W. One particular realization of the coupled equations is seen to be similar but not identical to the Lovelace form of the Faddeev equations. Since the matrix form of the coupled equations is similar to the one-body Lippmann-Schwinger equation, the introduction of Moeller wave operators is straightforward, and these are used to derive coupled integral equations for the channel state vectors. (NL)

16132 SUBMERSIVE EQUIVALENCE CLASSES FOR METRIC FIELDS. Kiehn, R. M. (Univ. of Houston, TX). Lett. Nuovo Cim.; 14: No. 9, 308-310(1 Nov 1975).

By utilizing the idea that all manifolds admit a global immersion into Euclidean space of possibly some higher dimension, a global metrical field may be induced on space-time. Emphasis is given to a unique global 1-form associated with the minus (timelike) sign in the metric signature. The idea is discussed that every global metric field falls into one of four equivalence classes of submersive maps, which identify all equivalent geometries that preserve the Pfaffian reducibility of the assumed 1-form. Possible correlation of the four classes with the four basic forces of physics is considered. (SDF)

16133 INTERNATIONAL CONFERENCE ON STATISTICAL PHYSICS, BUDAPEST, AUGUST 25-29, 1975. Abstracts of the Contributed Papers. Menyhard, N. (ed.). Budapest; Akademiai Kiado (1975). 269p. (CONF-750874-(Absts.)). $14.00.

From international conference on statistical physics; Budapest, Hungary (25 Aug 1975).

Abstracts are presented from sessions on the following subjects: fundamental problems and rigorous results; many-body problems; phase transitions and critical phenomena; open systems — systems far from thermal equilibrium; equilibrium properties of fluids; and transport processes and kinetic theory. (RWR)

16134 UNBOUNDED DERIVATIONS OF C* ALGEBRAS. Robinson, D. W. (California Univ., Berkeley (USA). Dept. of Physics). pp 303-311 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 8 refs.

Various new results which characterize infinitesimal generators are announced and described, and a review of general results is given. Although these results have not as yet had any striking application to physical theories, the authors hope that this theory will eventually play the same useful role that the Hilbert space theory plays. (DE)

16135 AN ALGEBRAIC APPROACH TO THE THEORY OF K-FLOWS AND K-ENTROPY. Emch, G. G. (Rochester Univ., N. Y. (USA). Dept. of Mathematics; Rochester Univ., N. Y. (USA). Dept. of Physics and Astronomy). pp 315-318 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 3 refs.

An algebraic approach to the theory of Kolmogorov and Sinai is proposed. It includes as particular cases both the classical theory and a generalization to non-commutative dynamical flows. The connection between the latter case and the statistical mechanics of a quantum diffusion process is presented. (DE)

16136 ALGEBRAIC CRITERION OF QUASICONFORMALITY FOR RIEMANNIAN DIFFERENTIAL SPACES. Pierzchalski, A. (Inst. of Mathematics, Lodz, Poland). Bull. Acad. Pol. Sci., Ser. Sci. Math. Astron. Phys.; 23: No. 3, 305-313(Jul 1975).

The connections between the conformality or quasi-conformality and the algebraic structure of some function algebras was previously studied. For instance Bers [1], Kakutani [6], Rudin [14], Roydan [13], Heins [5], Nakai [10], etc., considered this problem for Riemann surfaces, Lewis [9]—for Euclidean spaces, Leiong-Ferrand [8]—for Riemannian manifolds. The idea of quasiconformality on Riemannian differential spaces is introduced, and the analogous problem of determining the quasiconformality for diffeomorphisms of Riemannian differential spaces by isomorphisms of some function algebras on them is studied. (auth)

16137 GENERALIZED RECURRENT SPACES OF SECOND ORDER. Ashok Kumar Ray. Bull. Acad. Pol. Sci., Ser. Sci. Math. Astron. Phys.; 23: No. 3, 259-265(Jul 1975).

A type of nonflat Riemannian space V_n whose curvature tensor R_{hijk} satisfies a given relation is considered. First, the condition for uniqueness of β_m and α_{lm} and symmetry of the latter were studied. Then a number of results were deduced for this space with or without further curvature restrictions. (auth)

16138 FINITENESS OF DISCRETE SPECTRUM OF THE THREE-PARTICLE SCHROEDINGER OPERATOR. Yafaev, D. R. (Leningrad State Univ.). Teor. Mat. Fiz.; 25: No. 2, 185-195 (Nov 1975). (In Russian).

The Schroedinger operator H of a three-particle system with two-body interactions is considered. Under the assumptions that two-particle subsystems do not possess any negative eigenvalues and one of the subsystems has a virtual state at the lower bound of the continuous spectrum, the proof of the finiteness of discrete spectrum of operator H is performed. (auth)

16139 CLASSICAL ASYMPTOTICS OF THE FREE SCHROEDINGER EQUATION FOR CALCULATING THE CORRECTIONS IN THE STATIONARY PHASE METHOD. An, L. V. (Moscow State Univ.). Teor. Mat. Fiz.; 25: No. 2, 270-274(Nov 1975). (In Russian).

New formulas are obtained for the corrections to the asymptotics of the integral according to the stationary phase method. To this end the WKB approximation for the Schroedinger equation is used. The residual term for the asymptotical series over the small parameter powers representing the expansion of the integral of quickly oscillating functions is obtained. (auth)

16140 QUANTUM EXPANSION OF SOLITON SOLUTIONS. Christ, N.H.; Lee, T.D. (Columbia University, New York, New York 10027). Phys. Rev. D 12: No. 6, 1606-1627 (15 Sept 1975).

A systematic quantum expansion of soliton solutions to nonlinear field equations is developed. The method is based on the standard canonical quantization procedure. When the nonlinear coupling g is small, the Hamiltonian is $O(g^{-2})$ and its quantum eigenstates take on a WKB form, giving a direct connection between the quantum description and the corresponding classical soliton solution (which can be in any dimension, either time-dependent or time-independent). Our general method is illustrated by a variety of one-space-dimensional examples, some new and some old. (auth)

16141 DETERMINATION OF PHASE SHIFTS IN SCATTERING PROBLEMS BY A VARIATIONAL METHOD. Fuheng, W. Chin. J. Phys. 23: No. 6, 283-286 (Nov 1974).

We introduce a functional which leads to a simpler method of finding an approximate solution to the Schrödinger equation. (AIP)

Quantum Field Theories

Refer also to abstracts 15689, 15759–15762, 15767, 15783, 15798, 15799, 15831, 15855, 15879, 15886, 16218, and 16223.

16142 (CNRS-CPT-73P-550(Vol.2), pp C7.0-C7.12) SHORT-DISTANCE BEHAVIOUR OF THE PHOTON-PROPAGATOR. de Rafael, E. 1973.

From 3rd international colloquium on advanced computing methods in theoretical physics; Marseille, France (25 Jun 1973).

In third international colloquium on advanced computing methods in theoretical physics. Marseille, June 25–29 1973. (Centre National de la Recherche Scientifique, 13–Marseille (France). Centre de Physique Theorique).

In the study of the short-distance behavior of the photon propagator, one has to calculate exactly a few low order terms in perturbation theory of some fundamental functions. Calculations of this type are reviewed. (FR)

16143 (IFA-FT-117-1975) RENORMALIZATION GROUP EQUATIONS WITH MULTIPLE COUPLING CONSTANTS. Ghika, G.; Visinescu, M. (Institutul de Fizica Atomica, Bucharest (Romania)). 1975. 14p. Dep. NTIS (US Sales Only) $3.50.

The main purpose is to study the renormalization group equations of a renormalizable field theory with multiple coupling constants. A method for the investigation of the asymptotic stability is presented. This method is applied to a gauge theory with Tukawa and self-quartic couplings of scalar mesons in order to find the domains of asymptotic freedom. An asymptotic expansion for the solutions which tend to the origin of the coupling constants is given. (auth)

16144 (ITP-75-34R) EQUIVALENCE THEOREM AND RENORMALIZATION THEORY. Putenberg, M. L. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1975. 20p. (In Russian). Dep. NTIS (US Sales Only) $3.50.

The renormalization of the physical constants is studied in the S-matrices corresponding to Lagrangian densities which are connected by local field transformation. (auth)

16145 EVALUATION OF HIGHER-ORDER EFFECTIVE POTENTIALS WITH DIMENSIONAL REGULARIZATION. Lee, S. Y. (Purdue Univ., Lafayette, Ind. (USA). Dept. of Physics); Sciaccaluga, A. M. (California Univ., San Diego (USA)). Nucl. Phys., B; 96: No. 3, 435-444(29 Sep 1975).

A new and simple method for evaluating high-order effective potentials is presented. It is based on the renormalization procedure of 't Hooft and Veltman used in conjunction with the scheme of dimensional regularization. Explicit calculations of the effective potential of a scalar field in two-loop approximation are carried out. (NL)

16146 FIXED MASS AND SCALING SUM RULES. Generalized Truncation and Current Algebra Constraints on Regge Residues. Ward, B. F. L. (Stanford Linear Accelerator Center, Calif. (USA)). Nucl. Phys., B; 96: No. 3, 445-461(29 Sep 1975).

Using the correspondence principle (continuity in dynamics), the approach of Keppell-Jones-Ward-Taha to fixed mass and scaling current algebraic sum rules is extended so as to consider explicitly the contributions of all classes of intermediate states. A natural, generalized formulation of the truncation ideas of Cornwall, Corrigan, and Norton is introduced as a by-product of this extension. The formalism is illustrated in the familiar case of the spin independent Schwinger term sum rule. New sum rules are derived which relate the Regge residue functions of the respective structure functions to their fixed hadronic mass limits for $q^2 \to$ infinity. (NL)

16147 EVALUATION OF FUNCTIONAL INTEGRALS FOR AN ULTRALOCAL STATIC FIELD THEORY. Dosch, H. G. (Heidelberg Univ. (F. R. Germany). Inst. fuer Theoretische Physik). Nucl. Phys., B; 96: No. 3, 525-534(29 Sep 1975).

Exact and perturbative solutions of an ultralocal, static, real ϕ^m field theory, obtained by functional integral methods are given and discussed. It is shown that this unrenormalizable theory leads to a free one in the local limit, whereas a small non-locality leads to a small effective coupling constant in an effective ϕ^4 Lagrangian. It is proved that the usual perturbation series is the asymptotic expansion of the exact result. (NL)

16148 EVIDENCE FOR ALMOST POINT-LIKE BEHAVIOR OF OFF-SHELL PARTICLES IN FIELD THEORY. Orzalesi, C. A. (Parma Univ. (Italy). Istituto di Fisica); Sucher, J.; Woo, C. H. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Phys. Lett., B; 58: No. 3, 328-332(15 Sep 1975).

Evidence is given in favor of the possibility that, in contrast to the rapid decrease of on-shell form factors, the off-shell form factors for both elementary and composite hadrons decrease as $(q^2)^{-1}$ when the invariant momentum transfer q^2 becomes asymptotically large. Experimental implications are discussed. (NL)

16149 FORMULA OF TWO-LOOP COUNTER-TERMS FOR BOSE FIELD THEORIES WITHOUT DERIVATIVE INTERACTIONS. Tamura, S. (Hokkaido Univ., Sapporo). Lett. Nuovo Cim.; 13: No. 17, 639-644(23 Aug 1975).

It is shown that one can really derive a very simple formula of the two-loop counter terms for Bose field theories without derivative interactions. This formula is also useful since it reduces tedious and nontrivial calculations to those of several lines. (JFP)

16150 SUPERSYMMETRIC GAUGE THEORIES IN TWO DIMENSIONS. Ferrara, S. (European Organization for Nuclear Research, Geneva). Lett. Nuovo Cim.; 13: No. 17, 629-635(23 Aug 1975).

For the construction of supersymmetric gauge theories in two dimensions, one starts with the construction of supersymmetric Lagrangians. One uses the technique of superfields in two dimensions by a straightforward adaptation of the known technique in four dimensions. For the pure supersymmetric Yang–Mills interaction, it is found that the Lagrangian contains the usual Yang–Mills interaction of a vector boson, a spinor, and a pseudoscalar, and an additional Yukawa interaction among the pseudoscalar and the spinor. All these fields belong to the adjoint representation of the Yang–Mills group. When a supersymmetric matter field is added (an additional scalar and a spinor are present), the Lagrangian contains, beyond the new Yang–Mills couplings, additional Yukawa and quartic interactions. In the Abelian situation one has what should be called the supersymmetric extension of Schwinger quantum electrodynamics. (JFP)

16151 SUPERFIELD PROPAGATOR IN A CURVED SUPERSPACE. Srivastava, P. P. (Centro Brasileiro de Pesquisas

Fisicas, Rio de Janeiro). Lett. Nuovo Cim.; 13: No. 18, 657-660(23 Aug 1975).

The structure of the superspace associated with a given group of transformations is studied. Also a modification suggested in the equation of motion of a scalar superfield and in its propagator is discussed. It is noted that the discussion may be extended to other types of superfields. (JFP)

16152 QUANTIZATION OF NON-LINEAR WAVES. Jackiw, R. (Massachusetts Inst. of Tech., Cambridge (USA). Lab. for Nuclear Science; Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Physics). pp 394-400 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 5 refs.

In some models the classical field equations possess stable static solutions. It is suggested that they indicate that the particle spectrum of the theory is richer than has been heretofore assumed. In addition to the conventional particles of the theory, there also appear heavy particles, which carry a new quantum number and are stable. A systematic approximation is described with which the properties of these new particles can be exposed. (DE)

16153 REPRESENTATIONS OF THE CAR GENERATED BY REPRESENTATIONS OF THE CCR. Fock Case. Garbaczewski, P. (Wroclaw Univ. (Poland). Instytut Fyziki Teoretycznej). Commun. Math. Phys.; 43: No. 2, 131-136(Jul 1975). 11 refs.

A method is presented for constructing the Fock representation of the canonical anticommutation relations in the Fock representation of the canonical commutation relations. An explicit formula for Fermi creation and annihilation operators in terms of Bose ones is given. (DE)

16154 BOSE QUANTUM FIELD THEORY AS AN ISING FERROMAGNET: RECENT DEVELOPMENTS. Simon, B. (Princeton Univ., N. J. (USA). Dept. of Physics; Princeton Univ., N. J. (USA). Dept. of Mathematics). pp 543-553 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 35 refs.

A review is given of the latest developments in the approximation of scalar field theory by Ising models and the resulting correlation inequalities. (DE)

16155 THE $:\varphi^2:$ FIELD IN THE $P(\varphi)_2$ MODEL. Klein, A. (California Univ., Irvine (USA). Dept. of Mathematics); Landau, L. J. (Louvain Univ. (Belgium). Inst. for Theoretical Physics). Commun. Math. Phys.; 43: No. 2, 143-154(Jul 1975).

Euclidean Field Theory techniques are used to study the Schwinger functions and characteristic function of the $:\varphi^2:$ field in even $P(\varphi)_2$ models. The infinite volume limit is obtained for Half-Dirichlet boundary conditions by means of correlation inequalities. Analytic continuation yields Lorentz invariant Wightman functions. It is shown that, in the infinite volume limit, $[:\varphi(\chi)^2:] \geq 0$ for both the Half and the Full-Dirichlet $(\Lambda\varphi^4)_2$ model. This result also holds for a finite volume with periodic boundary conditions. (DE)

16156 CONTINUOUS REPRESENTATIONS OF THE TEST FUNCTION ALGEBRA AND THE EXISTENCE PROBLEM FOR QUANTUM FIELDS. Lassner, G. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Mathematisches Inst.). pp 297-302 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 1 fig.; 15 refs.

Wightman functionals with certain properties are discussed as well as C^*-like topologies on the test function algebra. (DE)

16157 THE INFRARED PROBLEM AND NON-FOCK REPRESENTATIONS OF THE CANONICAL COMMUTATION RELATIONS. Reents, G. (Wuerzburg Univ. (F. R. Germany). Physikalisches Inst.). pp 293-296 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 9 refs.

Starting with the Fock space, new representations of the canonical commutation relations are constructed. The representation is cyclic, irreducible, and unitarily inequivalent to the Fock representation. (DE)

16158 ALGEBRAIC ASPECTS OF WIGHTMAN QUANTUM FIELD THEORY. Borchers, H. J. (Goettingen Univ. (F. R. Germany). Inst. fuer Theoretische Physik). pp 283-292 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 25 refs.

A review is given of the representation theory of the Wightman field theory, which is nothing else than the representation of a well defined algebra, the so-called test-function algebra. (DE)

16159 THE STATISTICS OF PARTICLES IN LOCAL QUANTUM THEORIES. Doplicher, S. (Rome Univ. (Italy). Istituto di Matematica). pp 264-273 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 3 refs.

Some results of possible statistics compatible with general principles are described. The main topics are superselection sectors and statistics, gauge groups and parastatistics, statistics, and particles. (DE)

16160 REGULARIZATION IN THE CALLAN-SYMANZIK EQUATION. Fujii, Y. (Tokyo Univ. (Japan). Dept. of Physics); Takahashi, Y. (Alberta Univ., Edmonton (Canada). Dept. of Physics). pp 261-263 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 6 refs.

The conservative approach of canonical theory of broken scale invariance to the Callan-Symanzik equation is pushed further with the Pauli-Villars regulators. It is confirmed that the Callan-Symanzik equation is derived in a completely general manner. (DE)

16161 STRUCTURE OF RENORMALIZED FEYNMAN AMPLITUDES. Zavialov, O. I. (AN SSSR, Moscow. Matematicheskij Inst.). pp 256-260 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 8 refs.

The main topics are zero finite renormalization and arbitrary finite renormalization. Also discussed are the counterterms to which an R-operation corresponds, and generalizations are given. (DE)

16162 REVIEWS ON AXIOMATIC STUDY OF SYMMETRY BREAKING. Reeh, H. (Goettingen Univ. (F.R. Germany). Inst. fuer Theoretische Physik). pp 249-255 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 14 refs.

Work on the notion of spontaneously broken symmetry is limited. The Wightman framework of relativistic quantum field theory is used, and in the end the framework has to be enlarged slightly to account for supergauge transformations. Also used are the algebra of unbounded strictly local fields, the Hilbert space, the unique vacuum vector and the unitary representation of the Poincare group. (DE)

16163 QUANTUM FIELD-THEORETICAL APPROACH TO SPONTANEOUSLY BROKEN GAUGE INVARIANCE. Nakanishi, N. (Kyoto Univ. (Japan). Research Inst. for Mathematical Sciences). pp 245-248 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 6 refs.

A review is given of the Higgs mechanism, adding some new results, and mentioning its application to the Schwinger model done mainly by K. R. Ito. The main topics are the Goldstone theorem and the Schwinger mechanism. (DE)

16164 PATH INTEGRALS IN RIEMANNIAN MANIFOLDS. DeWitt-Morette, C. (Texas Univ., Austin (USA). Dept. of Astronomy; Texas Univ., Austin (USA). Center for Relativity). pp 535-542 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 8 refs.

This paper considers configuration spaces which are Riemannian multiply connected manifolds with a metric and a fundamental group. There is also considered a transformation of a Gaussian pseudomeasure under a linear mapping and the Feynman-Green function. (DE)

16165 FEYNMAN PROPAGATORS ASSOCIATED WITH THE VENEZIANO MODEL. Minami, M. (Kyoto Univ. (Japan). Research Inst. for Mathematical Sciences). pp 175-179 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975).

An attempt is made to find out if Veneziano's dual-resonance model contains something which corresponds to the Feynman-Dyson perturbation theory within the functional-integral formalism. It is shown that it is possible if the number of transverse degrees of space-time is 24 and the intercept of the leading Regge trajectory is unity. (DE)

16166 BOUND STATES AND ASYMPTOTIC FIELDS IN MODEL FIELD THEORIES. Kato, Y. (Utsunomiya Univ. (Japan). Dept. of Engineering Mathematics). pp 170-174 of International Symposium on Mathematical Problems in Theoretical Physics; Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 6 figs.

The existence of the asymptotic fields is generalized for bound states without the assumption of the Galilei invariance. (DE)

16167 SOLUBLE MODELS AND THE MEANING OF NON-RENORMALIZABILITY. Klauder, J. R. (Bell Telephone Labs., Inc., Murray Hill, N. J. (USA)). pp 160-169 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 1 fig.; 8 refs.

Some heuristic considerations of covariant field theory are given. These are followed by a variety of idealized models, the solutions of which exhibit the effect in question. Finally, the plausibility of the effect in covariant cases is argued. (DE)

16168 THE WIGHTMAN AXIOMS AND THE MASS GAP FOR WEAKLY COUPLED $(\Phi^4)_3$ QUANTUM FIELD THEORIES. Feldman, J. S.; Osterwalder, K. (Harvard Univ., Cambridge, Mass. (USA). Dept. of Mathematics; Harvard Univ., Cambridge, Mass. (USA). Dept. of Physics). pp 151-159 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 16 refs.

The weakly coupled $\lambda\Phi^4$ quantum field theory models in three spacetime dimensions exist and satisfy all the Wightman axioms. The mass operator $M = (H^2 - \vec{P}^2)^{\frac{1}{2}}$ has an isolated simple eigenvalue at zero and no spectrum in the interval (0,m) for some $m > 0$. (DE)

16169 FIELD THEORY OF RELATIVISTIC STRINGS. Kikkawa, K. (Osaka Univ., Toyonaka (Japan). Dept. of Physics). pp 128-137 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 7 figs.; 3 refs.

Recent development of the dual resonance model is reviewed: the quantum mechanics of a relativistic free string is presented by putting the emphasis on the gauge invariance and the Poincare invariance; the second quantized formalism of the string model is demonstrated; the equivalence of the string theory to the dual resonance model is shown. (DE)

16170 PARTICLES AND BOUND STATES AND PROGRESS TOWARD UNITARITY AND SCALING. Glimm, J. (Rockefeller Univ., New York (USA)); Jaffe, A. (Harvard Univ., Cambridge, Mass. (USA)). pp 118-127 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 50 refs.

A survey is given on recent developments in constructive quantum field theory. The program starts with an approximate field theory whose existence is known and constructs a Lorentz covariant limit as the approximations are removed. Frequently it has been convenient to work in the path space world of imaginary time. The Osterwalder-Schrader axioms give sufficient conditions on the Euclidean Green's functions (i.e. the path space theory in the case of bosons) to allow analytic continuation back to real (Minkowski) time and a verification of all Wightman axioms. (DE)

16171 NEW EXACT SOLUTIONS OF THE CLASSICAL YANG-MILLS FIELD EQUATION. Hosoya, A.; Ishida, J. (Osaka Univ., Toyonaka (Japan). Dept. of Physics). pp 238-239 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 3 refs.

A method to solve the gauge field equation in the case of magnetostatics is presented. (DE)

16172 RENORMALIZATION OF SUPERSYMMETRIC GAUGE THEORIES. Slavnov, A. A. (AN SSSR, Moscow. Matematicheskij Inst.). pp 214-217 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 5 refs.

Supersymmetric generalization of gauge theories was first given by Wess and Zumino. They worked in a nonsupersymmetric gauge, so it was far from evident that the resulting renormalized theory was supersymmetric. Here, a manifestly supersymmetric renormalization procedure for gauge theories is proposed. (DE)

16173 DISPERSION APPROACH TO WARD-TAKAHASHI IDENTITIES. Nishijma, K. (Tokyo Univ. (Japan). Dept. of Physics). pp 205-213 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 2 refs.

This is a brief summary of a series of papers on the derivation of various Ward-Takahashi identities. The conventional field theoretical calculations often lead to ambiguities and also miss anomalies. The S matrix theory is free from these objections. But there is not a complete set of dispersion relations so that the theory represents an approximate dynamical scheme. This approach is standing midway. It is based on unitarity and dispersion relations. The object is the complete collection of Green's functions for which there is a complete set of dispersion relations. This provides a convenient basis for deriving various Ward-Takahashi identities unambiguously. (DE)

16174 SPACE-TIME APPROACH TO ANOMALIES IN THE WARD-TAKAHASHI IDENTITIES AND AMPLICATIONS IN PHYSICAL PROCESSES. Nakazawa, N. (Kogakuin Univ., Tokyo (Japan). Dept. of Physics); Yamada, M. (Miyazaki Univ. (Japan). Medical Coll.). pp 202-204 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 7 refs.

Schreier discussed the axial type 3-point functions under the assumption that the conformal invariance and the $SU(3) \times SU(3)$ symmetry become exact at the short distance. Here his analysis is extended to the cases of 4-point and 5-point functions in detail and the anomalies in the Ward-Takahashi identities are obtained in a simple non-perturbative way. It is shown that the pinching mechanism is the common origin of the anomalies. (DE)

16175 INVARIANT GAUGE FAMILIES INHERENT IN ABELIAN-GAUGE FIELD THEORY. Yokoyama, K.; Kubo, R. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). pp 199-201 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 5 refs.

Some universal features inherent in the whole neutral-vector field theory are presented. The problem essentially concerns an aspect on gauges. (DE)

16176 BOUND STATE NATURE AND DEEP INELASTIC STRUCTURE FUNCTIONS. Ninomiya, M.; Watanabe, K. (Nagoya Univ. (Japan). Dept. of Physics). pp 111-113 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 11 refs.

It has recently become of interest to study the short distance behavior of the current product via applied field theoretic approach. The purpose of this note is to discuss the effect of bound states on the deep inelastic structure functions by taking a composite model for hadrons in a bona fide relativistic field theory. (DE)

16177 THE LOCALITY CONDITION IN PARAFERMI FIELD THEORY. Ohnuki, Y. (Nagoya Univ. (Japan). Dept. of Physics); Kamefuchi, S. (Tokyo Univ. of Education (Japan). Dept. of Physics). pp 107-110 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 6 refs.

A system is considered consisting of a single parafermi field of order p which satisfies the usual trilinear commutation rela-

tions. The decomposition theorem is presented. Under condition of weak locality, the result is that a single field describes two species of particles, which can be identified with the muon and electron. (DE)

16178 MASSLESS SUPERRENORMALIZABLE AND NON-RENORMALIZABLE THEORIES. Symanzik, K. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F.R. Germany)). pp 102-106 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 5 refs.

Massless superrenormalizable and nonrenormalizable theories cannot be constructed in perturbation theory. The massless IR case and massless or massive UV cases are discussed. (DE)

16179 CONFORMAL INVARIANCE IN MINKOWSKIAN QUANTUM FIELD THEORY AND GLOBAL OPERATOR EXPANSIONS. Schroer, B. (Freie Univ. Berlin (F.R. Germany). Inst. fuer Theoretische Physik). pp 92-101 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 16 refs.

Two main problems in conformal-invariant quantum field theory are considered on which there has been some recent progress: the construction of the correct global conformal transformation of fields consistent with the Einstein causality structure; the validity of global conformal operator expansions on and away from the vacuum. (DE)

16180 STRUCTURE OF SINGULARITIES OF WIGHTMAN DISTRIBUTIONS AND THE WILSON-ZIMMERMANN EXPANSION RESPECTIVELY: LIGHT CONE EXPANSION. Schlieder, S. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (F. R. Germany)). pp 85-91 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 11 refs.

For a relativistic quantum field theory of Wightman type necessary and sufficient conditions are formulated for the existence of a Wilson-Zimmermann expansion (short distance expansion). One can deduce a light cone expansion for those fields which fulfill our sufficient conditions from the short-distance expansion. (DE)

16181 ASYMPTOTICS AND LIGHT-CONE SINGULARITIES IN QUANTUM FIELD THEORY. Bruening, E.; Stichel, P. (Bielefeld Univ. (F.R. Germany). Abt. Theoretische Physik). pp 72-84 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 11 refs.

For a local amplitude, a one-to-one correspondence is proved between properly defined scaling, the leading light-cone singularity and the asymptotic behaviour of the corresponding Jost-Lehmann spectral function in the sense of distribution theory. (DE)

16182 SPECTRAL DEPENDENCE OF THE ANALYTICITY DOMAIN OF LOCAL VERTEX FUNCTIONS. Sommer, G. (Bielefeld Univ. (F. R. Germany). Abt. Theoretische Physik). pp 66-71 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 2 refs.

A method is outlined which allows construction of the envelope of holomorphy for general local vertex functions with arbitrary mass spectrum. (DE)

16183 LARGE MOMENTUM BEHAVIOUR OF FEYNMAN AMPLITUDES. Pohlmeyer, K. (Hamburg Univ. (F.R. Germany). 2. Inst. fuer Theoretische Physik). pp 59-65 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 8 refs.

The complete asymptotic expansion of Feynman amplitudes for large values of the scale parameter is derived for Euclidean and Minkowski metrics. (DE)

16184 MASS SINGULARITIES OF FEYNMAN AMPLITUDES. Kinoshita, T. (Cornell Univ., Ithaca, N.Y. (USA). Lab. of Nuclear Studies); Ukawa, A. (Tokyo Univ. (Japan). Dept. of Physics). pp 55-58 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 4 figs.; 4 refs.

Singularities of Feynman amplitudes associated specifically with vanishing internal masses appear frequently in various applications of field theory. In examining the large momentum behaviour of Feynman amplitudes, we also encounter with such singularities since large momentum limit with fixed masses may be translated to certain zero mass limit with fixed momenta. It is the ultimate purpose to construct a general method for treating these so-called mass singularities. A brief account of the results obtained thus far is given here. (DE)

16185 ANALYTICITY PROPERTIES OF SCATTERING AMPLITUDES. A Review of Some Recent Developments. Iagolnitzer, D. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique). pp 1-12 of International Symposium on Mathematical Problems in Theoretical Physics. Araki, H. (ed.). Berlin, F. R. Germany; Springer (1975).

From international symposium on mathematical problems in theoretical physics; Kyoto, Japan (23 Jan 1975). 20 refs.

Some recent developments are presented on momentum-space analyticity properties of scattering amplitudes for multiparticle processes in relativistic quantum theory. A description is given of some results obtained in axiomatic quantum field theory and S-matrix theory, and some useful related mathematical results. (DE)

16186 SPECIAL RELATIVITY AND VERY LONG BASELINE INTERFEROMETERS. Robertson, D. S. Nature (London); 257: No. 5526, 467-468(9 Oct 1975).

It is stated that when baseline lengths approach the diameter of the earth relativistic effects become important, especially is geodesic applications, and failure to take these effects into account may result in errors equivalent to clock errors of the order of a few parts in 10^{12}. The correct method of making the correction involves the use of two coordinate systems, one being the source frame of reference and the other the frame of reference of one of the receivers. Application of this method is discussed, together with the basic equations involved. The equations are recast to convert unobservables into observables. (UK)

16187 SOME THEORETICAL AND EXPERIMENTAL ASPECTS OF THE TACHYON PROBLEM. Kirch, D. Int. J. Theor. Phys.; 13: No. 3, 153-173(Jun 1975).

The hypothetical existence of tachyons is re-examined. It was previously doubted whether tachyons would exist, for it can be shown with the space-time diagram used in the special theory of relativity that they are moving backward in time for some moving systems, and this would contradict the principle of causality. It is shown that it can be concluded from the Einstein–Planck frequency relation and the de Broglie wave equation that the absolute value of the mass of the tachyons must be much lower than the rest mass of the electrons—nearly zero. But that means that they do not have any measurable energy if they move with a finite value about c. But if tachyons with $v > c$ cannot be measured they cannot cause causality paradoxes. The limits of the photoproduction cross section for tachyons in lead can be given as $1.5\ 10^{-32} \leq \sigma < 7\ 10^{-31}$ cm^2. Further, it can be shown that the kinetic energy of the tachyons is identical to their total energy. It is seen that tachyons cannot be regarded as "faster than light particles"—they are more a new kind of luxons. If they were to be uncharged it would be nearly impossible to distinguish them from this class of particles. (auth)

16188 MODEL FIELD THEORY IN WHICH TWO NAMBU–GOLDSTONE SYMMETRIES ARE REALIZED BY ONE MASSLESS PSEUDOSCALAR BOSON. Almond, D. J. (Univ., Oslo). Int. J. Theor. Phys.; 12: No. 2, 103-134(Feb 1975).

A model field theory is considered consisting of two interacting Nambu–Jona–Lasinio spin ½ fields. Solutions are sought in which the symmetries are spontaneously broken by giving the fermions nonzero masses. Each of the two pairs of axial-vector vertex functions in the theory satisfy two coupled integral equations, which are solved in the "chain approximation". It is found that all four vertex functions have the same singularity structure, in particular a pole at $q^2 = 0$ corresponding to a massless pseudoscalar Nambu-Goldstone boson, and another pole corresponding to an axial-vector boson whose mass is cut-off dependent, but which for a certain range of values of f^2 is a stable particle. By considering the coupling of the strings of nucleon-antinucleon pseudoscalar "bubbles" which generate the massless Nambu–Goldstone bosons associated with fermions 1 and 2, it is shown explicitly that there is only one massless Nambu–Goldstone boson in the theory. (auth)

16189 OUTLINE OF AXIOMATIC RELATIVISTIC QUANTUM FIELD THEORY. Streater, R. F. (Bedford Coll., London). Rep. Prog. Phys.; 38: No. 7, 771-846(Jul 1975).

In order that fields can be treated as quantum systems, quantum mechanics needs to be carefully formulated. After a brief introduction to the problem, the Hilbert space approach of von Neumann and the C*-algebra approach of Segal are described. In both cases symmetry groups and superselection rules can be described, and the latter allow a spontaneously broken symmetry. The Wightman theory of fields, with the main results and recent generalizations, and the C*-algebra approach of Haag, which follows the same physical ideas but has become an independent theory capable of explaining superselection rules, are considered. Dispersion relations and the analytic properties in momentum space, with brief reference to the Froissart bound and other consequences of positivity, and finally, the Euclidean approach leading to a history integral formulation, are described. The review as a whole is a survey of the work over the period 1954 to 74. It is confined to relativistic theories, omitting applications to many-body theory and avoiding the actual solution of the field equations. (auth)

16190 INVERSE HIGGS PHENOMENON IN NONLINEAR REALIZATIONS. Ivanov, E. A.; Ogievetskii, V. I. (Joint Inst. of Nuclear Research, Dubna, USSR). Teor. Mat. Fiz.; 25: No. 2, 164-167(Nov 1975). (In Russian).

In theories with nonlinearly realized symmetry it is possible in a number of cases to eliminate some initial Goldstone and gauge fields by means of putting appropriate Cartan forms equal to zero. This is called the inverse Higgs phenomenon. A general treatment is given of the inverse Higgs phenomenon for gauge and space-time symmetries and four instructive examples are considered which are the elimination of unessential gauge fields in chiral symmetry and in nonlinearly realized supersymmetry and also the elimination of unessential Goldstone fields in the spontaneously broken conformal and projective symmetries. (auth)

16191 INFRARED BEHAVIOR OF THE REGGEON FIELD THEORY FOR THE POMERON. Bardeen, W.A. (Fermi National Accelerator Laboratory, Batavia, Illinois 60510); Dash, J.W.; Pinsky, S.S.; Rabl, V. Phys. Rev. D 12: No. 6, 1820-1828 (15 Sept 1975).

The infrared structure of Reggeon field theory is investigated using renormalization-group methods. The infrared fixed point where only the φ^3 interaction is nontrivial is shown to be stable with respect to all higher-order interactions within the context of perturbation theory both at $D = 2$ and in the ϵ expansion. This may imply that the asymptotic behavior of the total cross section is model independent. (auth)

16192 BOUND STATES OF THE QUASIPOTENTIAL EQUATION FOR TWO SPIN-1/2 PARTICLES IN STRONGLY COUPLED QUANTUM ELECTRODYNAMICS. Crater, H.W. (Department of Physics and Astronomy, Vanderbilt University, Nashville, Tennessee 37235). Phys. Rev. D 12: No. 6, 1804-1812 (15 Sept 1975).

The bound states of two spin-1/2 particles in strongly coupled quantum electrodynamics are examined using a local quasipotential equation proposed by Todorov. Because of repulsive recoil effects displayed by the spatial part of the vector potential, complex energies do not appear for large α as with the static-limit equations, and very deep binding is obtained for α sufficiently large. No cutoffs or charge distributions need to be introduced to obtain this result. The generalized $^1S_0$ positronium system examined here appears to be confined to a thin spherical shell in this deep-binding limit. (auth)

16193 DYNAMICAL SYMMETRY BREAKING AS A BOOTSTRAP. Mannheim, P.D. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). Phys. Rev. D 12: No. 6, 1772-1793 (15 Sept 1975).

This paper is concerned with the bootstrap nature of dynamical symmetry breaking and with the infrared origins of the mass of the electron. We present a general calculational procedure for handling the situation in which a composite operator $\bar{\psi}\psi$ acquires a dynamical vacuum expectation value. We apply our procedure to finite quantum electrodynamics to show how the infrared divergences of the theory self-consistently cause $\langle\bar{\psi}\psi\rangle$ to become nonzero nonperturbatively so that it can provide a scale for a purely dynamical electron mass. Since no Goldstone boson need accompany this spontaneous breakdown, the electron mass bootstraps itself about the γ_5 degenerate vacuum. The mechanism also yields a new eigenvalue condition for the fine-structure constant. We discuss the deep interplay between the ultraviolet and the infrared, a characteristic feature of dynamical symmetry breaking. We use this interplay to show how to extend the Wilson operator-product expansion to the situation in which there is a degenerate vacuum. We discuss the possibility that the infrared structure of the weak interaction provides a dynamical origin for the Gell-Mann, Oakes, and Renner Hamiltonian. We indicate briefly the possibility that anomalous dimensions can soften a 4-Fermi interaction sufficiently to make it renormalizable. (auth)

16194 GAUGE THEORY AT FINITE TEMPERATURE OF SU(3)-SYMMETRY BREAKING AND QUARK MASSES. Eliezer, S. (Theoretical Division, Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87543). Phys. Rev. D 12: No. 6, 1739-1741 (15 Sept 1975).

SU(3) breaking is described in a renormalizable gauge field theory at finite temperature. At high temperature a phase transition occurs and SU(3) becomes an exact symmetry. In a theory with one single parameter $e^2/4\pi = 1/137$, we estimate the masses of $\mathfrak{P}$ (or $\mathfrak{N}$) and λ quarks to be greater than 300 MeV and 7000 MeV, respectively. However, for a small Yukawa coupling or at high temperature these values can be reduced to ~ 10 MeV and ~ 200 MeV, respectively. (auth)

16195 CLASSICAL LIMIT OF QUANTUM ELECTRODYNAMICS. Dente, G.C. (Arthur Holly Compton Laboratory of Physics, Washington University, St. Louis, Missouri 63130). Phys. Rev. D 12: No. 6, 1733-1738 (15 Sept 1975).

Employing the path-integral formulation of quantum electrodynamics, we perform a functional integration to eliminate the photon coordinates. The classical limit (including radiation reaction) emerges when this is done subject to the conditions that the initial photon state is the vacuum while the final photon state is the coherent radiation field. (auth)

16196 EXACTLY SOLVABLE TWO-DIMENSIONAL U(n) GAUGE-FIELD THEORY AND ITS CONSEQUENCES. Bhattacharya, G.; Roy, P. (Tata Institute of Fundamental Research, Bombay 400005, India). Phys. Rev. D 12: No. 6, 1721-1728 (15 Sept 1975).

Thirring-Wess and Schwinger models generalized to U(n) symmetry are explicitly solved by using the operator solution to the U(n) symmetric Thirring model. The gauge-invariant SU(n) current densities vanish identically, indicating the absence of colored physical states. The fermion screening mechanism occurs entirely due to the masslessness of the Abelian vector-boson field. There is no dynamical generation of mass for the non-Abelian vector bosons, which have to have zero mass for the solvability of the model. (auth)

16197 NON-ABELIAN GAUGE FIELDS AS NAMBU-GOLDSTONE FIELDS. Cho, Y.M.; Freund, P.G.O. (The Enrico Fermi Institute and the Department of Physics, The University of Chicago, Chicago, Illinois 60637). Phys. Rev. D 12: No. 6, 1711-1720 (15 Sept 1975).

Gauge invariance is obtained as a *consequence* of the spontaneous breaking of a larger symmetry. The Yang-Mills gauge fields are the corresponding Nambu-Goldstone fields. This involves the study of field theories in a space with more than four dimensions. In a "cylindrical" sector these field theories reduce to new non-Abelian generalizations of Jordan-Brans-Dicke theory. The nonobservability of the excess dimensions (while a difficulty for theories in which these dimensions are bosonic) should cause no problems if the higher dimensions are fermionic. In the latter case, field theories in which all basic fields are at the same time Nambu-Goldstone and Yang-Mills fields become possible. The relation of this work to recent work on gravitation theory by Yang is explored. (auth)

16198 QUANTUM "SOLITONS" WHICH ARE SU(N) FERMIONS. Halpern, M.B. (Department of Physics, University of California, Berkeley, California 94720). Phys. Rev. D 12: No. 6, 1684-1699 (15 Sept 1975).

In two dimensions, we find a construction for an SU(N) quark field in terms of N real Bose fields. Hence, equivalence is shown between certain massive SU(N) Thirring models and systems of quantum sine-Gordon-type equations. From the point of view of the bosons, the "soliton-quark" SU(N) is topological. To minimize guesswork in the development of such correspondences, we employ a systematic blend of Mandelstam's operator approach with the interaction picture. (auth)

16199 CANONICAL QUANTIZATION OF NONLINEAR WAVES. Tomboulis, E. (Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). Phys. Rev. D 12: No. 6, 1678-1683 (15 Sept 1975).

By means of a canonical transformation we investigate nonlinear field theories that possess exact classical solutions. This transformation is equivalent to the method of collective coordinates recently applied to the same problem by Gervais and Sakita using functional techniques. It is pointed out that, because of the operator orderings, extra terms occur in the quantized theory which seem to be absent in the straightforward functional approach. Ordinary perturbation treatment of the resulting Hamiltonian reproduces results previously obtained by Goldstone and Jackiw using a different technique. (auth)

16200 QUANTUM STRINGS AND THE FUNCTIONAL CALCULUS. Hopkinson, J.F.L. (Daresbury Laboratory, Daresbury, Warrington WA4 4AD, England); Tucker, R.W.; Collins, P.A. Phys. Rev. D 12: No. 6, 1653-1677 (15 Sept 1975).

The field theory of strings is developed using the functional calculus

as a practical technique. A Schrödinger-type equation and its eigensolutions are derived in light-cone coordinates. Vertices and amplitudes are represented entirely in a Fock space of second-quantized functionals. Two different open-string interactions are explicitly investigated. The three- and four-string vertex functionals are calculated for arbitrary times and compared with the asymptotic expressions obtained by other authors. We discuss how more exotic string configurations can be incorporated into the theory and emphasize the utility of the functional calculus in describing these topologies. (auth)

16201 SEMICLASSICAL CROSSING SYMMETRY FOR SEMICLASSICAL SOLITON SCATTERING. Coleman, S. (Lyman Laboratory of Physics, Harvard University, Cambridge, Massachusetts 02138). Phys. Rev. D 12: No. 6, 1650-1652 (15 Sept 1975).

Crossing symmetry (in a modified form) survives in semiclassical computations of relativistic particle scattering, and provides a nontrivial consistency test of such computations. The calculation of soliton scattering by Jackiw and Woo passes this test. (auth)

16202 SEMICLASSICAL SCATTERING OF QUANTIZED NONLINEAR WAVES. Jackiw, R.; Woo, G. (Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). Phys. Rev. D 12: No. 6, 1643-1649 (15 Sept 1975).

The relation between semiclassical phase shift and time delay, familiar from quantum mechanics, is extended to quantum field theory. This provides a semiclassical description of the scattering of quantized nonlinear waves. After a study of Levinson's theorem, our methods are applied to the sine-Gordon theory and the nature of the forces arising here is discussed. Finally, a covariant perturbative expansion for the one-particle sector is derived. (auth)

16203 QUANTIZATION OF SUPERSYMMETRIC GAUGE THEORIES. de Wit, B. (Institute for Theoretical Physics, State University of New York at Stony Brook, Stony Brook, New York 11794). Phys. Rev. D 12: No. 6, 1628-1642 (15 Sept 1975).

We consider the quantization of supersymmetric gauge theories in a rather general class of gauges. A generating functional is constructed that is supersymmetric, for which we formulate the Ward-Takahashi identities of the local gauge invariance. The existence of a supermultiplet of ghost fields is established. We present several examples to demonstrate the consistency of our approach. (auth)

16204 QUANTUM FLUCTUATIONS IN A ϕ^4 FIELD THEORY. II. ONE-MODE APPROXIMATION. Chang, S. (Physics Department, University of Illinois, Urbana, Illinois 61801); Wright, J.A. Phys. Rev. D 12: No. 6, 1595-1605 (15 Sept 1975).

We study the effect of quantum fluctuations on one-particle states in a ϕ^4 field theory, using a self-consistent Hartree-type approximation. For one-particle states, the presence of quantum fluctuations implies that perturbation theory should not be done about the c-number constant field associated with the vacuum, but rather one should start with a space-dependent classical field specially chosen for the single-particle state. The classical field no longer obeys the classical field equations; it emerges from a self-consistent calculation including the effect of quantum fluctuations. In this paper, we make a further approximation by keeping only the lowest quantum mode in the fluctuation (i.e., the one-mode approximation.) We demonstrate that the inclusion of a single mode in the quantum fluctuations is enough to produce many physically interesting results which are qualitatively different from those obtained in a purely classical system. In particular, we find that a stable "baglike" solution emerges naturally. We determine the particle wave functions, the space-dependent classical fields, and the energies of these baglike one-particle states explicitly in both the weak- and the strong-coupling limits. We exhibit the numerical solutions for intermediate coupling strengths. Finally, we discuss briefly the connections of our solutions and the kink-antikink bound-state solutions obtained by Dashen, Hasslacher, and Neveu. (auth)

16205 COMPOSITE FIELD THEORY AND VECTOR MESON DOMINANCE (vmd), PARTIAL CONSERVATION OF THE AXIAL VECTOR CURRENT (pcac), FIELD-CURRENT IDENTITY, AND SOME PROBLEMS IN CURRENT ALGEBRA. Zuo-xiu, H.; Tao, H. (Institute of Atomic Energy, Academia Sinica). Chin. J. Phys. 23: No. 6, 257-262 (Nov 1974).

We apply composite field theory to the derivation of vector meson dominance, the partial conservation of the axial vector current, and a series of new field–current relations. We also derive an algebraic expression satisfied by fields and currents. We thus demonstrate that a unified theoretical foundation can be provided for theories in these disparate domains. (auth)

16206 REGGEON FIELD THEORIES FOR s-CHANNEL DISCONTINUITIES AND MULTIPLICITY DISTRIBUTIONS. Suranyi, P. (University of Cincinnati, Cincinnati, Ohio 45221). Phys. Rev. D 12: No. 7, 2124-2132 (1 Oct 1975).

Reggeon field theories are proposed for the calculation of s-channel discontinuities of scattering amplitudes in contrast to usual Reggeon field theories, which provide the amplitude itself. Self-consistency restricts the values of coupling constants and implies a pure imaginary coupling constant for the usual Reggeon field theory. Multiplicity distributions are discussed as an application. A ϕ^3 Reggeon field theory leads to Koba-Nielsen-Olesen scaling, while a ϕ^4 theory leads to a Poisson-type multiplicity distribution. (auth)

16207 REGGEIZATION AND THE QUESTION OF HIGHER-LOOP RENORMALIZABILITY OF GRAVITATION. Grisaru, M.T.; van Nieuwenhuizen, P.; Wu, C.C. (Department of Physics, Brandeis University, Waltham, Massachusetts 02154). Phys. Rev. D 12: No. 6, 1563-1572 (15 Sept 1975).

We study the factorization of gravitational Born amplitudes and the Reggeization of the graviton. Factorization holds at $J = 2$, and the Mandelstam counting argument shows that the graviton must Reggeize, at least to low orders in perturbation theory. The Mandelstam argument also explains the one-loop renormalizability properties of pure gravitation and matter-gravity systems and is used to discuss the higher-loop renormalizability of pure gravitation. (auth)

16208 INFRARED-DIVERGENCE PROBLEM: RELATION OF THE ZWANZIGER ANSATZ TO THE DOLLARD-KULISH-FADDE'EV APPROACH. Rohrlich, F. (Department of Physics, Syracuse University, Syracuse, New York 13210). Phys. Rev. D 12: No. 6, 1832-1833 (15 Sept 1975).

A simple relation is derived between the ansatz for the asymptotic distorted electron field recently suggested by Zwanziger and the electron field associated with a suitable asymptotic Hamiltonian as required by Dollard and by Kulish and Fadde'ev for an infrared-divergence-free quantum electrodynamics. (auth)

16209 INFRARED EFFECT OF THE GOLDSTONE BOSON AND THE ORDER PARAMETER. Matsumoto, H.; Papastamatiou, N.J.; Umezawa, H. (Department of Physics, University of Wisconsin–Milwaukee, Milwaukee, Wisconsin 53201). Phys. Rev. D 12: No. 6, 1836-1839 (15 Sept 1975).

We present a physical argument to show that the influence of infrared Goldstone bosons precludes the appearance of spontaneous breakdown in one space dimension, or in two space dimensions when the temperature is not zero. The argument includes the case when gauge fields are present and a Higgs mechanism is operating. (auth)

16210 BOUND-STATE SOLUTIONS OF THE DIRAC EQUATION IN EXTENDED HADRON MODELS. Nohl, C.R. (Joseph Henry Laboratories, Princeton University, Princeton, New Jersey 08540). Phys. Rev. D 12: No. 6, 1840-1842 (15 Sept 1975).

We discuss numerical solutions for the classical boson fields in the four-dimensional SU(2) model of Dashen, Hasslacher, and Neveu. For their separation of the Dirac equation, a fermion in the classical Yang-Mills field has one bound-state solution with zero binding energy; consequently the model will not bind fermions, and is unstable. The Dirac equation for a fermion on an Abelian vortex line likewise has no bound-state solutions except for zero binding energy. (auth)

16211 RESTRICTION ON NONSINGULAR GAUGE CONDITIONS. de Wit, B. (Institute for Theoretical Physics, State University of New York at Stony Brook, Stony Brook, New York 11794). Phys. Rev. D 12: No. 6, 1843-1846 (15 Sept 1975).

We demonstrate in several examples that to give a consistent treatment of gauge theories a new restriction on the gauge condition is required. When a quadratic gauge-fixing term $-F^2/2$ is used in the Lagrangian only those gauges are allowed where F has a zero vacuum expectation value. We also present a more general, but heuristic argument why this must be the case. (auth)

16212 ASYMPTOTIC BEHAVIOR AND SYMMETRY BREAKING. Ahmed, M.A. (Department of Theoretical Physics, University of Oxford, Oxford, England). Phys. Rev. D 12: No. 6, 1847-1849 (15 Sept 1975).

The asymptotic behavior of Green's functions for large spacelike momenta in the presence of symmetry breaking is considered using the renormalization-group approach. The disappearance of symmetry-breaking effects due to a generalized mass term in the deep Euclidean region allows us to derive a certain inequality satisfied by a function simply related to the Callan-Symanzik function of a "dimensional" coupling constant of the theory. The inequality holds at a fixed point of the renormalization group. (auth)

Gravitation and General Relativity

Refer also to abstracts 15444–15446, 15513, 15517, 15518, 15766, 15767, 15799, 16197, and 16207.

16213 (A-75-23317) BI-METRIC THEORY AND SINGULARITIES IN RELATIVITY. Rosen, N. (Technion-Israel Inst. of Tech., Haifa). 1974. 41p.

From 3rd international school of cosmology and gravitation, course on the nuclei of galaxies, black holes, and collapsed matter; Erice, Italy (8 May 1974).

A bi-metric formulation of the general theory of relativity is presented. In this formulation, a second metric tensor is assigned to each point of space-time (a four-dimensional, Riemannian curved space with its own associated metric tensor) by mapping the Riemannian space on a flat space with which the second tensor is associated. The presence of the flat-space metric tensor is shown to improve the formalism of general relativity. Physically, it enables one to distinguish between the true gravitational field and the inertial field. An attempt is made to set up a bi-metric theory of gravitation which satisfies the covariance and equivalence principles, but is different from general relativity. In particular, the black-hole singularity is eliminated. A comparison is made between models of stellar structure and gravitational collapse obtained using general relativity and the bi-metric gravitation theory. (IAA)

16214 PROBLEM OF GRAVITATIONAL RADIATION. Kalckar, J. (Niels Bohr Institutet, Copenhagen); Ulfbeck, O. K. Dan. Vidensk. Selsk., Mat.-Fys. Medd.; 39: No. 6, 1-16(1974).

The problem of gravitational radiation is discussed. First, from classical electrodynamics those basic principles are isolated, the joint validity of which implies the occurrence of electromagnetic radiation, and it is investigated to what extent conclusions regarding gravitational radiation can be based solely on the same premises. Next, the consequences are explored of introducing new features, which – like the equivalence principle – distinguish between gravitational and electromagnetic interactions. (auth)

16215 APPLICATIONS OF VARIATIONAL PRINCIPLES TO CLASSICAL PERTURBATION THEORY IN GENERAL RELATIVITY. Robinson, D. C. (King's Coll., London). Math. Proc. Cambridge Philos. Soc.; 78: No. 2, 351-356(Sep 1975).

The equations satisfied by perturbations of solutions of the Euler–Lagrange equations corresponding to a Lagrangian density L are derived from the first and second variations of L, and these new Lagrangian densities are used to construct Noether and Euler identities. It is shown how these identities can be used in general relativity to construct conserved quantities and local uniqueness theorems. (auth)

16216 SCALE DEPENDENCE AND THE RENORMALIZATION PROBLEM OF QUANTUM GRAVITY. Deser, S.; Grisaru, M. T.; van Nieuwenhuizen, P.; Wu, C. C. (Brandeis Univ., Waltham, Mass. (USA). Dept. of Physics). Phys. Lett., B; 58: No. 3, 355-356(15 Sep 1975).

Although Einstein theory is obtainable from a Weyl (scale) invariant model by a particular gauge choice, this imposes no conditions on its counterterms. The absence of certain non scale-invariant counterterms in Einstein-Yang-Mills (or Maxwell) theory is traced instead to invariance under vector field duality rotations. (NL)

16217 A STATIC AXISYMMETRIC SOLUTION OF THE EINSTEIN EQUATIONS. Esposito, F. P.; Witten, L. (Cincinnati Univ., Ohio (USA)). Phys. Lett., B; 58: No. 3, 357-360(15 Sep 1975).

A family of static, axisymmetric, asymptotically flat solutions of the Einstein equations is discussed. A source with an exterior described by a member of this family initially could have an area smaller than that of an appropriately defined Schwarzschild surface. Intuition does not suggest the fate of the collapsing source. (NL)

16218 MASTER EQUATION FOR PERTURBATIONS TO THE SCHWARZSCHILD GEOMETRY. Lun, A. W. C. (Monash Univ., Clayton, Australia); Fackerell, E. D. Lett. Nuovo Cim.; 13: No. 18, 653-656(23 Aug 1975).

A Schroedinger-type equation for the gauge-dependent Newman-Penrose quantity Ψ_{2B} by making a suitable choice of gauge is presented. Particular emphasis is placed on infinitesimal coordinate transformations (gauge freedom) and infinitesimal tetrad rotations (tetrad freedom). Thus a complete set of perturbation equations together with an algorithm for the determination of all perturbed quantities (including gauge-dependent quantities) is now available. The method has proven useful in the derivation of a master equation for coupled electromagnetic–gravitational perturbations of the Reissner–Nordstroem geometry. (JFP)

16219 PETROV'S CLASSIFICATION OF TRAVELING AND STANDING GRAVITATIONAL WAVES. Grishchuk, L. P.; Sazhin, M. W. (State Astronomical Inst., Moscow). Dokl. Akad. Nauk SSSR; 223: No. 1, 72-75(1 Jul 1975). (In Russian).

An invariant description of gravitational emission is ordinarily related with an algebraic classification of the gravitational field according to Petrov. The analogy of a traveling gravitational wave with electromagnetic waves was also widely used. An electromagnetic resonator of toroidal form in which a variable electromagnetic field is excited has served as an emitter of standing gravitational waves in the laboratory. The plane standing waves are analyzed, and found to belong to type I or type O. The traveling wave field generally belongs to type N in analogy with traveling electromagnetic waves. The field of cylindrically-symmetrical standing gravitational waves is also classified into type I generally and also into types II, D and O for separate lines. Cylindrically-symmetrical, standing, linearly-polarized electromagnetic waves possess analogous properties. (SJR)

16220 ONE POSSIBLE CALCULATION OF EFFECTS OF THE GENERAL THEORY OF RELATIVITY. Gallova, M.; Ryba, M. (Komenskeho Univ., Bratislava). Acta Fac. Rerum Nat. Univ. Comenianae, Phys.; 15: 15-24(1975). (In Czech).

The calculation of three basic effects of the general theory of relativity is performed in the so-called isotropic coordinates by means of the line element ds^2 derived by Hood. It turns out that the calculation leads to the same expressions as those performed by means of the Schwarzschild element ds^2. (auth)

16221 PRINCIPLE OF EQUIVALENCE FOR SPIN. Adamowicz, W.; Trautman, A. (Univ., Warsaw). Bull. Acad. Pol. Sci., Ser. Sci. Math. Astron. Phys.; 23: No. 3, 339-342(Jul 1975).

It is pointed out that the motion of spin of a classical particle moving in a gravitational field satisfies a principle similar to the principle of equivalence of inertial mass and gravitational charge. The torsion of space-time may be measured by observing the precession of spin of a particle. The precession is predicted by the Einstein–Cartan theory of gravitation. (auth)

16222 EXPERIMENTAL VERIFICATION OF THE ABSOLUTE SPACE–TIME THEORY. I. Fundamental Conception of the Absolute Space–Time Theory. Marionov, S. Int. J. Theor. Phys.; 13: No. 3, 189-212(Jun 1975).

The fundamental postulate of the absolute space-time theory is the constancy of light velocity only with respect to absolute space. This postulate was proved right by a recently performed "coupled-mirrors" experiment (Czechoslovak J. Phys.; B24: 965(1975)). It is shown that the so-called Newtonian and Einsteinian time synchronizations lead respectively to the Galilean and Lorentz transformations. Both types of synchronization can be practically realized, hence both corresponding transformations describe the physical reality at low as well as at high velocities of the material points. The conception that the Einstein time dilation is an absolute phenomenon and the Lorentz length contraction a fiction is defended. (auth)

16223 CRUX OF THE CLOCK PARADOX. Epstein, K. J. Int. J. Theor. Phys.; 12: No. 2, 135-139(Feb 1975).

The central riddle or crux of the relativistic clock paradox is studied with methods that are familiar from thermodynamics and hamiltonian mechanics, but which are not usually used, to relate theory to phenomenology in the context of relativistic chronometry. Contrasting ramifications of the special and general theory are considered. (auth)

16224 EQUIVALENCE PRINCIPLE; AND REPLY BY N. T. BISHOP, AND P. T. LANDSBURG. Marsh, G. E. (Univ. of Chicago); Nissim–Sabat, C.; Rosser, W. G. V. Nature (London); 257: No. 5526, 517-518(9 Oct 1975).

Comments are offered on the papers by Bishop and Landsberg (Nature 252 : 359 (1974)) and Kilmister (Nature 252 : 439 (1974)) with regard to the equivalence principle as applied to gravitational redshift, retardation of clocks, and space-time curvature. It is stated that some of the arguments used are invalid. A reply by Bishop and Landsberg is appended, together with a contribution by W. G. V. Rosser (see also Nature 257 : 518 (1975)). (UK)

16225 SOLUTION OF THE ZERO REST-MASS EQUATIONS FOR FREE FIELDS IN THE EINSTEIN STATIC UNIVERSE. Klotz, F. F. (Trinity Coll., Dublin). Int. J. Theor. Phys.; 13: No. 3, 175-181(Jun 1975).

Solutions to the source-free spin s zero rest-mass equations in the Einstein static universe are obtained by means of the Newman–Penrose spin coefficient formalism. (auth)

16226 GRAVITATIONAL ANALOGUE OF THE MAGNETIC FORCE AND REPLY. Lorrain, P. (Montreal Univ., Quebec); Menzel, D. H.; Salisbury, W. W. Nature (London); 257: No. 5522, 161-162(11 Sep 1975).

Reference is made to Salisbury and Menzel (Nature 252: 664 (1974)), who considered the case of a pair of charged masses separated by a distance, r, and moving together at a velocity, v, in the direction perpendicular to the line joining their centers,

the charges and masses being chosen so that the electrical and gravitational forces cancelled one another in the moving coordinate system. An expression was derived for the gravitational equivalent of the magnetic force. This is criticized from relativity considerations. A reply is appended. (UK)

16227 THEORIES OF GRAVITY WITH STRUCTURE-DEPENDENT γ'S. Camenzind, M. (Institute for Theoretical Physics, University of Berne, 3012 Berne, Switzerland). Phys. Rev. Lett. 35: No. 18, 1188-1189 (3 Nov 1975).

A gauge theory for the Lorentz connection of a space-time describes geometries of stars with variable parametrized post-Newtonian parameter γ; its value depends explicitly on the structure of a star: The value of γ for a neutron star is different from that for the solar system ($|\gamma_\odot^{-1}| \leq 10^{-2}$). Because of the absence of a "local parity invariance" γ is positive for ordinary stars and γ is negative for sources of gravity consisting of antimatter. (auth)

16228 WARD IDENTITIES IN GAUGE THEORIES OF GRAVITATION WITH HIGHER DERIVATIVES. Gavrielides, A.; Kuo, T.K.; Lee, S.Y. (Department of Physics, Purdue University, West Lafayette, Indiana 47907). Phys. Rev. D 12: No. 6, 1829-1831 (15 Sept 1975).

The quantization of gauge theories of gravitation with k^{-4} propagator is investigated with the functional integration method. It is found that gauge-fixing terms in these theories are quite different from those in ordinary gauge theories. Ward identities are then derived and used to show that there is no renormalization of the longitudinal parts of the two-point Green's functions, just as expected. It is also shown that in order to satisfy these identities the bare graviton propagator has to come from the term of the square of the Riemann curvature tensor in the Lagrangian. (auth)

16229 RESOLUTION OF AN AMBIGUITY IN THE DERIVATION OF THE LORENTZ-DIRAC EQUATION. Rowe, E.G.P. (Mathematics Department, Durham University, Durham, England). Phys. Rev. D 12: No. 6, 1576-1587 (15 Sept 1975).

An ambiguity in the derivation of the equation of motion of a charged point particle is exhibited. Using momentum conservation in the form $\int T^{\mu\nu} dS_\mu = 0$, one deduces the Lorentz-Dirac equation by integrating over one surface, and a different equation, with variable rest mass, by integrating over another. In the second case, the variability of the rest mass exactly compensates the Larmor radiation, and the Schott term is absent. In both cases, infinite mass renormalizations, of identical form, are required. These renormalizations are both covariant, but since they are only mathematically insecure parts of the derivations they are obviously responsible for the ambiguity. A distribution theory of the problem is set up to resolve the question. This theory, at its present stage of development, has its own types of arbitrariness, but making very natural choices, a perfectly definite and everywhere finite formulation results, out of which the Lorentz-Dirac equation emerges uniquely. And in this form, as an expression of $\partial_\mu T^{\mu\nu} = 0$, the theory clarifies the energy-momentum exchanges in the problem. (auth)

16230 GRAVITATING 't HOOFT MONOPOLES. Cho, Y.M.; Freund, P.G.O. (The Enrico Fermi Institute and the Department of Physics, The University of Chicago, Chicago, Illinois, 60637). Phys. Rev. D 12: No. 6, 1588-1589 (15 Sept 1975).

The 't Hooft magnetic monopole solution of the SO(3) Higgs model generates, when coupled to gravity, a geometry which for large distances is of the Reissner-Nordström form corresponding to a (magnetic) charge $1/e$. The Higgs fields can contribute a cosmological term. In the absence of scalar fields the corresponding Wu-Yang solution of the SO(3) gauge theory still generates the Reissner-Nordström geometry. (auth)

REACTOR TECHNOLOGY AND REGULATION

16231 DEVELOPMENT OF ADVANCED POWER REACTORS IN THE FEDERAL REPUBLIC OF GERMANY. Wirtz, K. (Karlsruhe Nuclear Research Center, Ger.). pp 33-54 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design, and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903.

A discussion is presented of the plans and activities by the German Federal Republic in the development of the following systems: HTGR type reactors, pebble bed reactors, HTR with direct cycle helium turbine, LMFBR type reactors, and GCFR type reactors. (DG)

16232 L'ENERGIE NUCLEAIRE: DONNEES TECHNIQUES, ECONOMIQUES, ECOLOGIQUES. (Nuclear Energy: Technical, Economic and Ecological Data). Paris, France; Delegation Generale a l'Information (1975). 119p. (In French)

Supplement No. 239 of Actualites Service.

The economic, industrial and ecological data from which the French nuclear energy program was worked out are presented, and the techniques by which the sites were chosen are described. The questions raised by the public are discussed, including dependence with respect to oil versus the advantages of nuclear energy, environment and siting problems, consequences for public health and radiation protection, and organization of nuclear industry. (FR)

16233 ANNUAL REPORT: 1974–1975. London; United Kingdom Atomic Energy Authority (1975). 80p. £1.25.

This report is in sections, entitled: general survey (nuclear power development, work outside the nuclear power field, finance, staff); research and development for nuclear power (gas cooled reactors, steam generating heavy water reactors, fast reactors, high temperature reactors, marine propulsion, nuclear safety and the environment, R and D contract work for the nuclear industry, controlled nuclear fusion, underlying research); work outside the nuclear power program (the non-nuclear program, the applied nuclear program (including a project to develop radioactive tracer techniques and radioisotope instruments for use in industry; hydrological tracers; and electrotechnology exploiting the design and manufacturing expertise of Culham Laboratory's fusion program)). Appendices include a list of the Authority's reactors and major facilities, and the functions of Authority establishments. The Authority balance sheet and accounts for the year are presented. (UK)

16234 NUCLEAR POWER AND OTHER ENERGY. Problems in Choosing. Doederlein, J. M. (Inst. for Atomic Energy, Kjeller, Norway). Forskningsnytt; 20: No. 4, 26-33(1975).

A comparison is made between nuclear power plants, gas-fueled thermal power plants and oil-fired thermal power plants with respect to health factors, economy, environment and resource exploitation, with special reference to the choice of power source to supplement Norwegian hydroelectric power. Resource considerations point clearly to nuclear power, but, while nuclear power has an overall economic advantage, the present economic situation makes its heavy capital investment a disadvantage. It is maintained that nuclear power represents a smaller environmental threat than oil or gas power. Finally, statistics are given showing that nuclear power involves smaller fatality risks for the population than many other hazards accepted without question. (auth)

16235 PROSPECTS FOR NUCLEAR POWER GENERATION IN PRIVATE INDUSTRY. Decker, G. L. (Dow Chemical Co., Midland, MD. Chem. Ind. (London); No. 17, 722-725(6 Sep 1975).

Two basic questions are considered with regard to the use of nuclear energy as an energy alternative for private industry. Firstly, how does nuclear power compare with other energy alternatives in costs as applied to private industry requirements, and secondly, what practical problems should a typical nuclear power generation project expect to encounter in private industry and how can they be surmounted. By way of example reference is made to a dual purpose nuclear facility under construction in Michigan, USA, to serve the electrical and process heat requirements of the Dow Chemical Co. and the electrical requirements of the Consumers Power Co. The former will require 3.5 M lb/hr. of steam, supplied from an extraction point between the high and low pressure turbine casings, and this steam will have already produced a substantial amount of electrical energy prior to delivery to Dow. After the energy contained in the steam has been utilized in the Dow processes it will be returned as condensate to the Power Co., thereby eliminating further condensing requirements. The overall energy conservation is expected to amount to nearly 20%. The facility is planned for completion in early 1980, and its estimated cost is in the range of 10^9 dollars, exclusive of nuclear fuel. (UK)

16236 THE BIVALENT HEATING—FUNDAMENTAL ASPECTS. Kalischer, P. Elektrawaerme Int., A, B; 33: No. 4, 175-181(Jul 1975). (In German).

15 figs.; 1 ref. Presented at the annual meeting of the Vereinigung Deutscher Elektrizitaetswerke, Jun 1975.

Bivalent heating systems provide the energy needed for room heating in buildings by means of two independent energy carriers which can be used simultaneously or alternatively. In both cases, the electric heating system provides the basic energy, while the fuel system supplies energy for the heat demand peaks. Basic criteria for an efficient combination of systems are given along with a comparison between bivalent and monovalent systems. The systems are discussed from the point of view of overall economy and electricity economy and from a consumer point of view. (DE)

16237 NUCLEAR ENERGY AND ENSURING THE LONG-TERM ENERGY SUPPLY IN THE GERMAN FEDERAL REPUBLIC. Report on the Reactor Conference 1975 in Nuernberg. Koenig, H. H. (Brown, Boveri und Cie A.G., Mannheim (F. R. Germany). Projekt Kernkraftwerke). At. Strom; 21: No. 7, 63-72(Jul 1975). (In German)

6 figs.; 2 tabs.

The author reports on the papers read at the Reactor Conference in 1975. He pays special attention to the development of energy supply from nuclear stations, investigates the motives behind the growing resistance of the public, and shows that the acceptance procedure ensures the construction and operation of safe nuclear power installations. He also discusses the possibilities of improved energy utilization, the climatic changes in coming generations, the characteristics of supply with nuclear district heating and process heat, as well as the state of building projects with high-temperature reactors and fast breeders. (DE)

16238 NUCLEAR PROCESS HEAT—A CONTRIBUTION TO ECONOMY. Schulten, R. pp 92-98 of Secure Energy - Save Energy. A Practical Handbook for All Users and Producers of Energy. Sterner, S. (ed.). Duesseldorf, F. R. Germany; Econ (1975). (In German)

1 fig.

A popularized introduction into the possible uses of nuclear process heat is presented. (DE)

Power Reactors, Non-Breeding, BWR-Type

Refer also to abstracts 16412, 16414, 16416, 16424, 16430, 16535, and 16555.

16239 (EUR-5289e) INVESTIGATIONS ON RADIOACTIVE FISSION PRODUCT CORRELATIONS: γ SPECTROMETRY MEASUREMENTS ON SPENT FUEL ASSEMBLIES OF THE GARIGLIANO REACTOR. Adiletta, G.; Benatti, N.; Guidotti, R.; Paoletti Gualandi, M.; Peroni, P.; Bresesti, A. M.; Bresesti, M.; D'Adamo, D. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1974. 39p. Dep. NTIS (US Sales Only) $5.00. EUR B. Fr. 140,-.

In the framework of a collaboration between ENEL and EURATOM (JRC Ispra), γ spectrometry measurements with a Ge(Li) detector were performed on 11 fuel assemblies of the Garigliano BWR, to study the correlations existing between radioactive fission products and burnup, plutonium content and power at the end of cycle. A mechanical and collimation system permitted measurements to be performed at different levels on the four corners of the fuel assemblies, in the spent fuel pond of the Garigliano plant. The γ ray activities of the fission products were correlated with values of burnup, plutonium content and power calculated by means of nuclear codes at the end of the cycle. (auth)

16240 (JUL-Conf-14) FUEL ELEMENTS FOR LWR, HTR, SNR, AND GSB. Status Report of Working Group of Fuel Elements, Juelich, Germany, 12–13 November 1974. Huerttlen, B. (ed.). (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany); Kerntechnische Gesellschaft im Deutschen Atomforum e.V., Bonn (F. R. Germany)). Jan 1975. 333p. (In German). (CONF-741169–). Dep. NTIS (US Sales Only) $19.75.

The papers presented at the conference considered four aspects of the fuel cycle: characteristics of the reactor system, design

requirements of the fuel elements, status and goals of fuel element development and enrichment, and closing the fuel cycle. The individual and panel discussions concluding each session are given. Individual abstracts were prepared. (JSR)

For abstracts of individual papers see: 16241–16244, 16255, 16264–16267, and 16295–16302.

16241 (JUL-Conf-14, pp 11-23) CHARACTERISTICS OF BOILING WATER REACTORS. Wallenwein, E. H. (Hamburger Elektrizitaetswerke, Ger.). Jan 1975. (In German)

From meeting of the Working Group of KTG and the Nuclear Research Establishment; Juelich, F. R. Germany (12 Nov 1974).

In fuel elements for LWR, HTR, SNR, and GSB.

In the review of the characteristics the topics discussed are: arrangement of the heat circuit, construction of the safety vessel, reactor pressure vessel, system design of the core, construction of the core, control, and fuel management. (JSR)

16242 (JUL-Conf-14, pp 103-115) DESIGN REQUIREMENTS OF LWR FUEL ELEMENTS. Holzer, R. (Kraftwerk Union, Erlangen, Ger.). Jan 1975. (In German)

From meeting of the Working Group of KTG and the Nuclear Research Establishment; Juelich, F. R. Germany (12 Nov 1974).

In fuel elements for LWR, HTR, SNR, and GSB.

The design of the PWR and BWR fuel elements is briefly described. Factors considered in the design are relation between the characteristics of the reactor system and the operational stresses on the fuel rods, dimensional changes of LWR fuel rods, and radio-induced elongation of the can and dimensional stability. (JSR)

16243 (JUL-Conf-14, pp 183-190) STATUS AND GOALS OF LWR FUEL ELEMENT DEVELOPMENT AND FABRICATION IN THE GERMAN FEDERAL REPUBLIC. Knoedler, D. (Kraftwerk Union, Erlangen, Ger.). Jan 1975. (In German)

From meeting of the Working Group of KTG and the Nuclear Research Establishment; Juelich, F. R. Germany (12 Nov 1974).

In fuel elements for LWR, HTR, SNR, and GSB.

The manufacturer and development studies of LWR fuel elements are summarized. (JSR)

16244 (JUL-Conf-14, pp 261-270) CLOSING THE LWR FUEL CYCLE. Schmiedel, P. (Kraftwerk Union, Erlangen, Ger.). Jan 1975. (In German)

From meeting of the Working Group of KTG and the Nuclear Research Establishment; Juelich, F. R. Germany (12 Nov 1974).

In fuel elements for LWR, HTR, SNR, and GSB.

A review of the problems in closing the LWR fuel cycle shows that the transport of the spent fuel elements is a controllable step. The existing and planned reprocessing plant capacities of the world are reviewed. The necessity of reprocessing facilities in the German Federal Republic and the problems to be resolved in their construction and operation are indicated. (JSR)

16245 (NEDO-11209-02) NUCLEAR ENERGY DIVISIONS BOILING WATER REACTOR QUALITY ASSURANCE PROGRAM DESCRIPTION. (General Electric Co., San Jose, Calif. (USA). BWR Projects Dept.). Dec 1975. 67p.

The QA Program which is applied generally throughout the GE Nuclear Energy Divisions, but which is specifically applicable to the safety-related functional aspects of systems and components within the domestic BWR scope of supply. This scope of supply includes nuclear steam supply systems, nuclear fuel, and the standard reactor island design (STRIDE). The QA Program is designed to provide assurance that the quality-related work elements for systems, components (including spares and replacement parts) and services included in the BWR scope of supply, are identified and controlled. Specific responsibilities of personnel and organizations are assigned and documented for quality-related activities throughout the major steps of design and construction of the nuclear power plant projects, encompassing the broad phases of: (1) Contract definition; (2) preliminary design; (3) systems and components design and specifications; (4) supplier evaluation and selection; (5) material and component procurement; (6) fabrication and assembly of components and systems; (7) inspection and testing; (8) cleaning, packing, and shipping; (9) installation and erection; and (10) preoperational and startup testing. (auth)

16246 (NEDO-21069) MARK III CONTAINMENT SEISMIC SLOSH. Reuter, F.; Petite, D. L. (General Electric Co., San Jose, Calif. (USA). BWR Projects Dept.). Dec 1975. vp. General Electric Co., San Jose, CA.

Analytical and experimental investigations were conducted to evaluate the influence of seismic induced slosh waves on the Mark III containment when subjected to earthquake loading. Most of the work was performed on a $\frac{1}{30}$ scale physical model of the 238 Standard Plant which was designed to provide information on basic liquid slosh responses. A $\frac{1}{15}$ scale model of the 238 Standard Plant was also tested to verify the analytical predictions for suppression pool and to determine natural frequencies. A detailed description is presented of the results obtained from the experiments on the scaled models and also on a corresponding analytical model. Fundamental studies are included which establish the appropriate scaling laws, and verify their applicability for sinusoidal type excitation. (auth)

16247 (PGE-8003(Rev.0)) NUCLEAR PROJECTS QUALITY ASSURANCE PROGRAM FOR DESIGN, CONSTRUCTION, AND PREOPERATIONAL TESTING. (Portland General Electric Co., Oreg. (USA)). Dec 1975. 94p.

The program for the control of quality-related activities of Portland General Electric during the design, construction, and preoperational testing of the Trojan and Pebble Springs Nuclear Stations is described. (JWR)

16248 CONDENSATE POLISHING IN NUCLEAR POWER PLANTS. Atoomenerg. Haar Toepass.; 17: No. 10, 210-213 (Oct 1975).

Condensate polishing is common practice in BWR and some types of PWR systems. However, there is a firm tendency to install condensate polishing in all PWR systems. The following systems for condensate polishing in nuclear power stations are applicable: high flow-rate deep-bed polishers having external regeneration; powdered resin filtration. Pre-filtration ahead of deep-bed polishing is not practiced currently and actual plant results show that pre-filtration is unnecessary. Most of the nuclear power stations are located near to the sea or have cooling towers and, therefore the cooling function is achieved either by brackish water or seawater. This type of cooling water forces the architect engineer of nuclear power plants to install a condensate polishing plant which can cope with condenser leakage. The current status and recent developments in condensate polishing are presented. (NL)

16249 UNIFORM CORROSION AND HYDROGEN PICK-UP OF ZIRCONIUM-BASE CLADDING MATERIALS IN BOILING WATER REACTORS. Videm, K. (Institutt for Atomenergi, Kjeller (Norway)). Nucl. Eng. Des.; 33: No. 2, 170-177(Sep 1975).

The corrosion rate of the Zircaloy cladding in BWRs is reasonably well predicted by the equation: corrosion rate = C X flux$^{\frac{1}{4}}$, where C is slightly temperature-dependent. Oxygen in BWR coolant reduces the hydrogen pick-up fraction leading to a low hydrogen pick-up despite increase in the corrosion. Hydrogenation of the PWR coolant increases hydrogen pick-up, but as the corrosion rate is nearly unaffected by irradiation under such conditions hydrogen absorbed by Zircaloy will be well below acceptance limits. The irradiation-induced increase in corrosion rate is lower for zirconium-niobium alloys than for Zircaloy, resulting in a lower rate for the former alloys under BWR conditions. This alone does not justify their application, as the uniform corrosion resistance and hydrogen pick-up properties of Zircaloy is fully satisfactory for use as cladding material in current water-cooled reactors. (NL)

16250 IMPROVED UNDERWATER LIGHT SMOOTHS NUCLEAR FUEL HAND. Stubbe, C. S. Electr. Light Power (Boston); 53: No. 9, 17-19(22 Sep 1975).

Underwater lighting equipment and techniques for BWR and PWR fuel handling operations are described. (DCC)

16251 METHODS FOR DETAILED THERMAL AND HYDRAULIC ANALYSIS OF WATER-COOLED REACTORS. Weisman, J. (Univ. of Cincinnati); Bowring, R. W. Nucl. Sci. Eng.; 57: No. 4, 255-276(Aug 1975).

The mathematical models and numerical techniques used for detailed, steady-state, thermal, and hydraulic analysis of water-cooled reactors are critically reviewed. It is concluded that the agreement between prediction and experiment is sufficiently close to validate the general approach. Further improvements in the models for cross flow and two-phase mixing are desirable. Future modeling that specifically accounts for the annular flow pattern at high qualities is suggested. (auth)

Power Reactors, Non-Breeding, PWR-Type

Refer also to abstracts 14862, 16240, 16242–16244, 16248, 16250, 16251, 16409, 16412–16416, 16424, 16427, 16430–16433, and 16535.

16252 (BAW-10029(Rev. 3)) CONTROL ROD DRIVE MECHANISM TEST PROGRAM. Revision 3. Williams, J. T.; Harris, R. E.; Ficor, J. (Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Div.). Nov 1975. 9p. Babcock and Wilcox Co., Lynchburg, VA.

A description is given of the testing and development of three control rod drive mechanisms for use on commercial PWR plants designed by B and W. The test results indicate that all three drives are reliable and ensure safe, dependable reactor operation. (auth)

16253 (BAW-10104(Rev.1)) B AND W's ECCS EVALUATION MODEL. Dunn, B. M.; Jones, R. C.; Cartin, L. R.; Parks, C. E.; Salm, R. J. (Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Div.). Dec 1975. vp. Babcock and Wilcox, Lynchburgh, VA.

The generic model for evaluating the performance of emergency core cooling systems following a loss-of-coolant accident for all B and W NSSs is developed and compared with the required and acceptable features contained in Appendix K of the Code of Federal Regulations, 10 CFR 50. Both the large- and small-break evaluation models are presented and are shown to conform to Appendix K. (auth)

16254 (CENPD-182) SEISMIC QUALIFICATION OF C-E INSTRUMENTATION AND ELECTRIC EQUIPMENT. MacNair, T. A. (Combustion Engineering, Inc., Windsor, Conn. (USA)). Nov 1975. vp. Combustion Engineering, Inc., Windsor, CT.

CENPD-182 is a summary of the C-E seismic qualification program utilized to demonstrate the seismic design adequacy of the instrumentation and control equipment used in C-E supplied Nuclear Steam Supply Systems (NSSS). Included in this report are the equipment seismic requirements, a description of the qualification methods, and a summary of the qualification effort for each equipment. Each equipment is qualified for use in a seismic environment where damage potential to the equipment is less than or equal to that simulated seismic environment to which it has been qualified. (auth)

16255 (JUL-Conf-14, pp 25-39) CHARACTERISTICS OF PRESSURIZED WATER REACTORS. Sommer, D. (Kernkraftwerk Obrigheim GmbH, Ger.). Jan 1975. (In German)

From meeting of the Working Group of KTG and the Nuclear Research Establishment; Juelich, F. R. Germany (12 Nov 1974).

In fuel elements for LWR, HTR, SNR, and GSB.

In a review of the characteristics the topics discussed are: construction singularities, coolant, control devices, and reactor physics characteristics. (JSR)

16256 (WCAP-7821(Supp. 2)(Add. 1)) SEISMIC TESTING OF ELECTRICAL AND CONTROL EQUIPMENT: STATIC INVERTER AND INSTRUMENT BUS DISTRIBUTION PANEL. Figenbaum, E. K. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Oct 1975. vp. Westinghouse Electric Corp., Pittsburgh, PA.

A description is presented of the seismic testing of the static inverter and the instrument bus distribution panel conducted during August 1975 at the Westinghouse Astronuclear Laboratory. The static inverter and instrument bus distribution panel were subjected to vibration tests over a range of 1 to 35 Hz which simulated the seismic conditions at the PG and E plant levels (high seismic plant level). The equipment was able to maintain the designed electrical output requirements for normal loads (which equal approximately 85 percent of rated capacity). The results showed neither discontinuity nor degradation of output requirements with this higher system load. (auth)

16257 EXTERNAL CORROSION OF CLADDING IN PWRs. Stehle, H.; Kaden, W.; Manzel, R. (Kraftwerk Union A. G., Erlangen (F. R. Germany)). Nucl. Eng. Des.; 33: No. 2, 155-169(Sep 1975).

In-reactor corrosion of Zircaloy is strongly influenced by the fast neutron flux and water chemistry of the primary coolant. Under typical PWR coolant conditions with low oxygen content the fast neutron flux increases the corrosion rate only slightly. On the other hand, under fast neutron irradiation at a high oxygen content in the primary coolant the corrosion is accelerated 5- to 10-fold. In addition localized oxide lenses (nodular corrosion) have been observed. However, hydrogen pick-up rates were generally low. The results are discussed in view of life-limiting aspects; under normal operating conditions of a PWR the external corrosion is not life limiting. (NL)

16258 SPECIAL FEATURES OF EXTERNAL CORROSION OF FUEL CLADDING IN BOILING WATER REACTORS. Lunde, L. (Institutt for Atomenergi, Kjeller (Norway)). Nucl. Eng. Des.; 33: No. 2, 178-195(Sep 1975).

The cases of fuel failure caused by corrosion reactions have so far been a result of localized corrosion, and not of a uniform attack. This report describes special features of external corrosion which under certain circumstances can endanger the integrity of the cladding. (NL)

16259 TEN YEARS OF OPERATIONAL EXPERIENCE OF THE NUCLEAR POWER PLANT NOVOVORONEZH. Grigorjanc, A. N.; Ovcinnikov, F. J.; Sedov, V. K.; Golubev, L. I.; Akkuratnov, J. A.; Prokopenko, I. V.; Kustov, I. I.; Isakov, N. A.; Dobrynin, V. D.; Cybul'nik, V. D. Arch. Energiewirtsch.; 29: No. 8, 768-779(Aug 1975). (In German).

2 figs.; 4 tabs. Also published in At. Ehnerg. (Jan 1975) v. 38(1) p. 3-10.

The operational experience with the four blocks of Novovoronezh nuclear power station is discussed, especially the adaptability of the plant, its main parts, and its safety. A fifth block is now under construction. (DE)

16260 FURTHER PLANNING OF NUCLEAR POWER PLANTS. Site Hamm-Uentrop. At.-Inf.; No. 7/8, 15-16(1975). (In German)

1 fig.

In the framework of their long-term plans to extend the capacities of their power stations, Vereinigte Elektrizitaetswerke Westfalen AG (VEW), Dortmund, and Elektromark Kommunales Elektrizitaetswerk Mark AG, Hagen, intend to construct a 1,300 MW nuclear power station on the site of the VEW Westfalen power station in Hamm-Uentrop. VEW holds 74% and Elektromark 26% of the shares of Kernkraftwerk Hamm GmbH (KKH) which has been founded for purposes of construction and operation. The nuclear power station ordered will have a pressurized-water reactor. (DE)

16261 BABCOCK-BROWN BOVERI PRESSURIZED WATER REACTORS. Davies, D. K. BBC-Nachr.; 57: No. 5/6, 238-242 (1975). (In German).

6 figs.

Pressurized water reactors supplied by Babcock-Brown Boveri Reaktor GmbH (BBR) for the generation of electric power are fully engineered, reliable plants. Three such units are in operation in the Federal Republic of Germany. BBR have been awarded a contract for the supply of a 1,300 MW(e) plant. The operating principles, the advantages of pressurized water reactors, and the experience gained so far are described. (DE)

Power Reactors, Non-Breeding, Graphite Moderated

Refer also to abstracts 14608, 14768, 16240, 16317, 16325, 16354, 16418, 16423, 16428, 16429, and 16437.

16262 (GA-A-13100) THREE DIMENSIONAL DEPLETION ANALYSIS FOR THE "AS BUILT" FSV INITIAL CORE. Nirschl, R. J. (General Atomic Co., San Diego, Calif. (USA)). 15 Nov 1975. Contract E(04-3)-633. 105p. Dep. NTIS $5.45.

During fabrication of the initial FSV core fuel elements, some difficulties with assayed quantities of uranium and thorium were encountered. This problem became apparent when about 40 percent of the total fuel rod requirement was in some state of production and about 10 percent of the fuel elements had been assembled. As a result, some of the specified fuel blends were nearing completion and the uranium and/or thorium was 3 to 4 percent too high or low, and some of the already assembled fuel elements were outside the loading tolerances given in the fuel specification. A description is given of the method of resolution of this problem with the minimum perturbation to the fuel production and no loss of integrity on the fuel performance. (auth)

16263 (JUL-1238) BEHAVIOUR OF TRITIUM IN REACTOR GRAPHITES. Fischer, P. G. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Reaktorentwicklung). Sep 1975. 102p. (In German). Dep. NTIS (US Sales Only) $5.50.

Laboratory experiments on the behavior of tritium and hydrogen in different graphite materials which are interesting for the HTR are described. With the aid of especially developed vacuum devices the diffusion and adsorption kinetics is measured isothermally and by the flash-filament-method. The detection of hydrogen is made by means of a mass spectrometric method. The tritium is measured after catalytic oxidation by liquid-scintillation. An absolute determination of the total content of tritium and hydrogen in the samples is attained by ashing and subsequent analysis of the combustion gases. From the measurements diffusion coefficients and desorption energies are evaluated. When these results are taken into account for the operation of the HTR, it can be stated that the actual tritium inventory is largely determined by the buffer properties of the graphite core. Thus, in the starting phase of HTRs, when higher tritium production rates are to be expected, the coolant gas activity which is responsible for a

tritium permeation through the heat exchangers, remains small. The predominant part of the produced tritium will be obtained in the reprocessing plants. (auth)

16264 (JUL-Conf-14, pp 41-53) CHARACTERISTICS OF HIGH TEMPERATURE REACTOR CORES. Brandes, S. (Hoc-temperaturreaktor-Bau GmbH, Mannheim, Ger.); Lohnert, G. Jan 1975. (In German)

From meeting of the Working Group of KTG and the Nuclear Research Establishment; Juelich, F. R. Germany (12 Nov 1974).

In fuel elements for LWR, HTR, SNR, and GSB.

In the review of the characteristics the topics discussed are: core design with spherical fuel elements, multiple loading, one-way loading, and core design with block fuel elements. (JSR)

16265 (JUL-Conf-14, pp 117-132) DESIGN REQUIREMENTS OF HTR FUEL ELEMENTS. Mittenbuehler, A. (Gesellschaft fuer Hochtemperaturreaktortechnik mbH, Bensberg, Ger.); Roellig, K. Jan 1975. (In German)

From meeting of the Working Group of KTG and Nuclear Research Establishment; Juelich, F. R. Germany (12 Nov 1974).

In fuel elements for LWR, HTR, SNR, and GSB.

The basic structure of coated fuel particles is outlined. The pin variant, block fuel element, and spherical fuel elements are considered. The design requirements of pebble bed reactors and reactors with block fuel elements are reviewed. In the design of fuel elements the factors considered are core design, stress analysis, corrosion, fission product release, and the particle behavior. (JSR)

16266 (JUL-Conf-14, pp 191-210) STATUS AND GOALS OF HTR FUEL ELEMENT DEVELOPMENT. Balthesen, E. (Kernforschungsanlage, Juelich, Ger.); Pfahls, O. Jan 1975. (In German)

From meeting of the Working Group of KTG and the Nuclear Research Establishment; Juelich, F. R. Germany (12 Nov 1974).

In fuel elements for LWR, HTR, SNR, and GSB.

The topics discussed are: coated fuel particles, spherical fuel elements, graphite block elements, and monolithic fuel elements. (JSR)

16267 (JUL-Conf-14, pp 271-279) HTR FUEL CYCLE: TECHNOLOGY AND STRATEGY. Tillessen, U. (HOBEG, Hanau, Ger.); Merz, E. Jan 1975. (In German)

From meeting of the Working Group of KTG and the Nuclear Research Establishment; Juelich, F. R. Germany (12 Nov 1974).

In fuel elements for LWR, HTR, SNR, and GSB.

The technology of the HTR fuel cycle (transport of the spent fuel elements, reprocessing, and refabrication) is reviewed on the basis of a reactor with block elements. The strategy for attaining the required technology is summarized. The significance of the Th cycle is briefly considered. (JSR)

16268 (ORNL-TM-5132) CRUSHING STRENGTH OF HTGR FUEL PARTICLES. Lackey, W. J.; Stinton, D. P.; Davis, L. E.; Beatty, R. L. (Oak Ridge National Lab., Tenn. (USA)). Jan 1976. Contract W-7405-eng-26. 20p. Dep. NTIS $5.00.

The whole-particle crushing strengths of High-Temperature Gas-Cooled Reactor fertile and fissile coated particles were measured and correlated with fabrication procedures. The crushing strength of Biso-coated fertile particles was increased by the following factors: (1) increasing the outer coating thickness by 10 mu m increased strengths by 0.3 lb (1.3 N) for annealed particles and by 0.5 lb (2.2 N) for unannealed particles. (2) An 1800°C postcoating anneal increased strengths by 1 lb (4.4 N) for particles with thick outer coatings and by 2 lb (8.9 N) for particles having thin coatings. (3) Increasing the inner coating density by 0.1 g/cm^3 increased strength by 0.6 lb (2.7 N). The crushing strength of Triso-coated fissile particles was proportional to the thickness of the SiC coatings, and strength decreased on annealing by about 0.2 lb (0.9 N) when a porous plate was used to distribute the coating gas and by about 1.5 lb (6.7 N) when a conical gas distributor was used. The strengths of fertile and fissile coated particles as well as uncoated kernels appear adequate to allow fuel fabrication without excessive particle damage. (auth)

16269 (ORNL-TM-5136) STATUS REPORT ON STRUCTURAL MATERIALS OF HTGR PRIMARY SYSTEM COMPONENTS. Rittenhouse, P. L.; Morgan, C. S. (Oak Ridge National Lab., Tenn. (USA)). Jan 1976. Contract W-7405-eng-26. 30p. Dep. NTIS $5.00.

Assessments of the status of technology of high-temperature gas-cooled reactor primary system structural materials and the implications of these in the prediction of component integrity and performance as related to safety are presented. An update of relevant information on the metallic materials used in the primary system is provided along with the results of initial assessment efforts on the core lateral restrain structure and control material components. No new materials-related safety questions of great urgency were encountered in the course of these studies but several items needing further consideration and investigation were identified. Assessment efforts to be undertaken during FY 1976 are described briefly. (auth)

16270 NUMERICAL RESEARCH ON THE PEBBLE BED REACTOR. Teuchert, E. (Kernforschungsanlage, Juelich, Ger.); Maly, V. pp 144-152 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

The switch-over between various fuel cycles is feasible with the OTTO-pebble-bed reactor without causing considerable difficulties during the reactor life. Under present conditions the thorium cycle with U-233 recycling brings the lowest fuel cycle costs of 1.84 mills/kWh$_e$. When desired because of increasing fissile material costs the conversion ratio can be increased up to 0.9 and by U-233 feed up to 0.96. (auth)

16271 TECHNIQUES FOR THE TREATMENT OF BIG CAVITIES IN PEBBLE BED REACTORS. Bernnat, W.; Holder, P.; Emendoerfer, D. (Univ., Stuttgart). pp 217-223 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

A description of the treatment of big cavities with inserted control rods in pebble bed reactors is given. Using appropriate response matrices in combining a diffusion theory treatment for the scattering media regions with a Monte Carlo treatment for the non diffusion area having inserted rods appears to be a promising method for calculating k_{eff}, flux, and power distributions. For a problem with an empty cavity, satisfactory agreement is found between S_N and diffusion theory treatments, if the latter takes into account the neutrons' free flight between the cavity boundaries. (auth)

16272 WIMS ANALYSIS OF THE ZERO ENERGY EXPERIMENTS PERFORMED ON THE DRAGON REACTOR. Lancefield, M. (United Kingdom Energy Authority, Winfrith, Eng.); Woloch, F. (Argonne National Lab., IL). pp 354-363 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

Since Charge II the Dragon Reactor has been used as an irradiation facility to test the materials and fuel design types relevant to the HTR system in operating conditions. A description is presented of the preliminary analysis of U-235 fission rate measurements at zero energy made prior to Charge IV with WIMS-E methods developed at AEE Winfrith. One of its aims is to demonstrate the kind of accuracy of prediction that the sponsors of the test experiments should expect from the use of sophisticated methods with the physical data currently available for this irradiation facility. (auth)

16273 DEVELOPMENTS OF HELIUM-COOLED REACTOR SYSTEMS. Fortescue, P.; Goodhohn, A. J.; Melese-d'Hospital, G. (General Atomic Co., San Diego, CA). pp 822-839 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

High-Temperature Gas-Cooled Reactor (HTGR) prototypes with a conventional steam cycle have been in operation since 1967; commercial stations are now starting or are under construction. The high helium temperature can also be used in a direct turbine cycle or for a number of process heat applications. Such systems are now under design in the U. S. and overseas. Helium cooling for fast breeders is also presently under development in a number of countries. Gas-Cooled Fast Breeder Reactors producing excess U-233 as makeup fuel for HTGRs lead to an overall system which makes most efficient and economic use of existing ore and water resources. (auth)

16274 PUTTING IN OPERATION OF BUGEY 1. Bertrand, G.; Denoyer, M. (Electricite de France, 75-Paris). Bull. Inf. A. T. E. N. (Assoc. Tech. Energ. Nucl.); No. 110, 5-23(1974). (In French)

The main items of equipment involved in the running of BUGEY 1, the test procedure adopted and the results obtained are re-

ported. The general testing phase was divided into three periods: aptitude, starting up, trial run. The aptitude period precedes reactor loading and was foreseen to test the state of the circuits and the reliability of each function. The ultimate phase involved the pneumatic testing of the pressure vessel. The start-up period lasted from January 1972 until the end of the same year. The power use tests took place in 7 steps increasing from 100 to 1750 MW(t). A revision period was organized during the summer of 1972. The trial run extended through December 1972 and into 1973. During two years industrial operation the number of control rod drops decreased gradually until September 1973, after which the plant ran continuously until June, 1974, date of the annual shut-down. A table gives the variation in production and availability of the unit. (FR)

16275 INSPECTION AND ACCEPTANCE OF CERAMIC REACTOR INSTALLATIONS FOR THE THORIUM-HIGH-TEMPERATURE-REACTOR (THTR). Fieguth, P.; Schulte-Oversohl, M. (Rheinisch-Westfaelischer Technischer Ueberwachungs-Verein e.V., Essen (F. R. Germany)). Fritz, R. (Hochtemperatur-Reaktorbau G.m.b.H., Mannheim (F.R. Germany)). Tonind.-Ztg. Keram. Rundsch.; 99: No. 4, 89-94(1975). (In German).

13 figs.; 3 tabs.; 8 refs.

By means of the reflector graphite the quality control of ceramic installations of the THTR is described. The quality requirements for ceramic parts are satisfied by a continuous control beginning in the production and terminated by the final installation. (DE)

16276 THE 300 MW-THTR NUCLEAR POWER STATION AT UENTROP. Energie; 27: No. 7, 210-211(Jul 1975). (In German).

1 fig.

A short review is given on the present state of affairs in the following fields: planning and construction, nuclear licensing, the state of work on the site, and the design and testing of the coolant gas blowers. (DE)

16277 MEASURING DEVICES FOR HIGH TEMPERATURE REACTORS. Kaiser, G. E.; Rechentin, U. (Hochtemperatur-Reaktorbau G.m.b.H., Mannheim (F.R. Germany)). Arch. Tech. Mess. Messtech. Prax.; 472: 65-70(May 1975). (In German).

4 figs.; 10 refs.

The instrumentation of helium-cooled, graphite-moderated high-temperature reactors is described. Following a discussion of the demands made on the measuring instruments and of the measuring concept, the examples of activity measuring in the chimney and failure detection in the liner insulation are dealt with. Also discussed are moisture measurements in the coolant gas. (DE)

16278 GESCHAEFTSBERICHT 1974. (Business Report 1974). Ahlen, F. R. Germany; Sommer (1975). 24p. (In German)

With figs. and tabs.

This report contains the agenda of the company meeting of 14-7-1975, the director's report, a suggestion for the treatment of the balance sheet data, the certification of the financial statement, as well as the balance of 31-12-1974 including the profit and loss account for the time between 1-1-1974 and 31-12-1974. The main project is the THTR-300 reactor whose construction progress, time situation and licensing procedure are reported. (DE)

16279 HIGH-TEMPERATURE REACTOR. van Glabbeek, G. J.; Kleine-Tebbe, A. BBC-Nachr.; 57: No. 5/6, 232-237 (1975). (In German)

6 figs.; 2 refs.

Following some introductory remarks on the concept and mode of operation of the HTGR type reactors, safeguards and operation of this type are described. (DE)

Power Reactors, Non-Breeding, Otherwise Moderated

Refer also to abstracts 16318 and 16535.

16280 (AECL-5229) SOME BASIC PHYSICS ASPECTS OF THE CANADIAN NUCLEAR POWER PROGRAM. Millar, C. H. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jul 1975. 11p. (CONF-7406114—1). Dep. NTIS (US Sales Only) $4.50.

From CAP-CAS congress; St. John, Newfoundland, Canada (10 Jun 1974).

Brief comments on reactor lattice and core physics are followed by a discussion of the physical principles of reactor control. First the role of delayed fission neutrons in slowing down the exponential divergence of a super-critical reactor is outlined. Next the physical basis of the various components of the power coefficient of reactivity is explained together with the methods of adjusting this coefficient toward the desired value. Finally, longer-term reactivity effects are discussed with emphasis on the several effects of Xe-135 "poison" on reactor design and operation. (auth)

16281 (INIS-mf-1778) CORDOBA NUCLEAR POWER PLANT. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). Jul 1974. 8p. (In Spanish). INIS.

A brief description is given of the studies and considerations which led to the design of the Cordoba nuclear power plant and the principal characteristics of this reactor, now under construction, are summarized. The reactor is of the CANDU type. (JSR)

Power Reactors, Breeding

Refer also to abstracts 15227, 16240, 16273, 16375, 16408, 16410, 16417, 16419, 16425, and 16426.

16282 (AEC-tr-7295, pp 39-44) EXPERIMENTAL POWER STATION WITH GAS-COOLED FAST REACTOR AND DISSOCIATING HEAT-TRANSFER MEDIUM (BRG-20). Krasin, A. K.; Nesterenko, V. B.; Kolykhan, L. I.; Bubnov, V. P.; Il'in, A. Ya.; Slizov, V. P.; Shufrov, Yu. V. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli i Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

Design parameters and a schematic diagram are presented for a N_2O_4 cooled fast reactor. The reactor is visualized as a 20MW(t) prototype of a large power plant and the basic construction is similar to the sodium-cooled BOR-60 reactor. (HDR)

16283 (AI-ERDA-13160) SODIUM TECHNOLOGY AND COVER GAS SEAL DEVELOPMENT PROGRAMS. Quarterly Technical Progress Report, July-September 1975. Welch, F. H.; Steele, O. P. III; Hill, E. (Atomics International Div., Cnaoga Park, Calif. (USA)). 15 Nov 1975. Contract AT(04-3)-824. 66p. AT.

Progress is reported in the areas of sodium removal-storage, alcohol process development, alcohol-sodium removal pilot facility, sodium-water reaction products removal, decontamination studies, general seal development, CRBRP rotating plug inflatable seal test, top shield dip seal configuration characteristics, advanced seals and geometry, advanced materials, and gamma irradiation. (DG)

16284 (ANL-CT-74-02) ASSESSMENT OF FLOW-INDUCED VIBRATIONS OF SELECTED UPPER PLENUM COMPONENTS IN THE HYDRAULIC CORE MOCKUP. Mulcahy, T. M.; Turula, P. (Argonne National Lab., Ill. (USA)). Dec 1973. Contract W-31-109-Eng-38. 38p. AT.

The calculated response of the components subject to the parallel flow conditions assumed was found to be small except in the case of the CLIRA when assumed free of core restraint. The small responses calculated for the components subject to the cross flow conditions assumed were indicative of the fact that most of the components were designed such that the vortex shedding frequency was considerably below the lowest structural natural frequency. The exceptional cases where significantly large response was predicted were the CRDM, the Closed Loop Duct free of core restraint, and the LLFM free at the top of the core. 10 references. (auth)

16285 (ANL-Trans-1009) CHANGES IN THE CONCEPTION OF THE STEAM GENERATORS AND THE INTERMEDIATE EXCHANGERS BETWEEN THE PHENIX PLANT AND THE 1200 MWe PLANT. Robin, M.; Perrin, R.; Pouderoux, P.; Tillequin, J. Translated from Bull. Inf. A.T.E.N. (Assoc. Tech. Energ. Nucl.); No. 96, 15-28(Jul 1972). 30p. Dep. NTIS $5.00.

The numerous studies and tests that are being carried out in France concerning the operation of the intermediate exchangers, and sodium heated steam generators, control functioning, verification of long term behavior and their resistance in case of any incident or accident are described. (auth)

16286 (ANL-Trans-1024) HEAT TRANSMISSION AND PRESSURE DROP IN THE STEAM GENERATORS HEATED BY SODIUM CIRCULATION. Robin, M. G. Translated from Rev. Gen. Therm.; 11: No. 132, 1189(1972). 40p. Dep. NTIS $4.00.

Heat transfer and pressure drop equations are presented which have received experimental verification from the tests of a liquid

metal heated steam generator module of the PHENIX type installed at the Station for Thermal Testing of the C.E.A. at Grand Quevilly. These laws seem valid for the straight tube apparatus (at least on the major part of their developed length) and should all be applicable to the new generator proposed by Stein Industry for the future fast neutron power plant. But again, there will have to be the validation of a whole new ensemble of laws to take into account the helicoidal tubes proposed by Babcock Atlantic for the same application: tests responding to this objective have already been running at Grand-Quevilly for several months. (auth)

16287 (ANL-Trans-1028) STUDY OF RANDOM HYDRODYNAMIC VIBRATIONS OF CERTAIN STRUCTURES IN THE REACTOR UNIT OF THE PHENIX. Lesueur, C.; Milan, D.; Payan, G. Translated from Nucl. Eng. Des.; 18: No. 2, 279-303(1972). 52p. Dep. NTIS $4.50.

An important source of vibrations in the vessels of a reactor such as the sodium cooled Phenix reactor is the turbulence of the liquid sodium flow. Random pressure pulsations may excite the natural modes of the structures if they are within the low frequency range. Studies were undertaken to ascertain whether the vessels and internals of the reactor were adequately stable and if not, to determine the necessary changes to achieve this aim. The vibrational characteristics of the considered structures were measured on mechanical models at the scales of 1/10 or 1/5 in the air as well as in quiet water simulating sodium. Pressure recordings carried on hydraulic models at the scale of 1/4 were analyzed for the statistical features of the pressure pulsations. The response of the structures was calculated analytically by using the theory of random vibrations of shells. An upper bound of the response was determined by using only the model characteristics and the power spectral density functions. This was sufficient to guarantee the mechanical stability of structures considered, after an eventual stiffening. (auth)

16288 (BNWL-tr-161) ULTRASONIC SWEEP ARM FOR SODIUM-COOLED REACTORS. Rohrbacher, H. A.; Bartholomay, R. (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Reaktorentwicklung). Nov 1975. Translation of KFK-2117. 25p. Dep. NTIS $3.00.

Experience is described in the use of a new type of monitoring and testing device to be applied in conjunction with components under sodium. In the method outlined, ultrasonic pulses are used which are emitted into the sodium plenum of fast breeder reactors by newly developed high temperature transducers. The basic work was conducted under out-of-pile conditions in a sodium tank of the sodium tank facility of the Karlsruhe Institute for Reactor Development. The sensor development, which preceded this phase, resulted in the use of soldered lithium niobate crystals whose operating characteristics were improved by the preliminary treatment outlined in the report. Special materials and techniques suitable for sensor fabrication are proposed. An alternative to soldering is suggested for contacting the crystals with their diaphragms, i.e., a contact pressure concept for the range of application up to 2 MHz. (auth)

16289 (CONF-751101--47) LMFBR SPENT FUEL AND NEW FUEL INSPECTION AND HANDLING. Youngquist, C. H. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-Eng-38. 26p. Dep. NTIS $5.00.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum; San Francisco, California, USA (16 Nov 1975).

If the hot cells used for inspection and preparation of liquid metal fast breeder reactor fuel assemblies can be located so that the fuel assemblies can be moved directly to and from the sodium filled decay storage tank, the fuel handling problems can be simplified and a fuel handling machine may be eliminated. The hot cells can also serve as a transfer lock through the outer containment barrier, thereby permitting uninterrupted reactor operation during fuel transfer to and from the decay storage tank. 5 references (auth)

16290 (COO-2245-23) COOLANT MIXING IN LMFBR ROD BUNDLES AND OUTLET PLENUM MIXING TRANSIENTS. Progress Report, March 1, 1975–May 31, 1975. Todreas, N. E.; Golay, M. W. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). 1975. Contract AT(11-1)-2245. 95p. AT.

Analytical and experimental work on coolant mixing in LMFBR rod bundles and outlet plenum is reported. (JWR)

16291 (EURFNR-1282) FAST REACTOR PROGRAM: FIRST QUARTER 1975 PROGRESS REPORT. Hoekstra, E. K. (comp.). (Stichting Reactor Centrum Nederland, Petten). Jul 1975. 52p. (RCN-228). Dep. NTIS (US Sales Only) $5.50.

Work performed under United States–Euratom Fast Reactor Exchange Program.

Results of calculations of the capture cross sections of the fission product nuclei ^{127}I and $^{101,102,104}Ru$ are given. The in-pile canning failure experiments on fuel pins R54-F35 and F39 and the loss-of-cooling experiments on fuel pins R63-L10 and L12 are described. Progress on the thermodynamic measurements on U(C,N) and on the thermodynamic stability study on cesium uranates is reported. A comparison of results of the low-cycle-fatigue tests on specimens of DIN 1.4948 base material and welded material is given. Aerosol experiments in the ENAK, PERVEX and "200" vessels are commented on. Evaluation of results of the hydraulic experiments with the seven-rod bundle mock-up in water and of the thermohydraulic tests performed on the artificially roughened rods LUCY 113 and 114 in air is discussed. (auth)

16292 (GEAP-10028-55) CORE ENGINEERING FIFTY-FIFTH QUARTERLY REPORT, MAY–JULY 1975. (General Electric Co., Sunnyvale, Calif. (USA). Fast Breeder Reactor Dept.). Aug 1975. Contract AT(04-3)-893. 40p. AT.

Progress is described for tasks related to Grid Spaced Driver Assembly, Wire-Wrap Assembly Engineering, Core Component, Structural Design Criteria, and Probabilistic Design. (auth)

16293 (GEAP-13771-16) CRITICAL EXPERIMENTS AND ANALYSIS SIXTEENTH QUARTERLY REPORT, JULY–SEPTEMBER 1975. (General Electric Co., Sunnyvale, Calif. (USA). Fast Breeder Reactor Dept.). Oct 1975. Contract E(04-3)-893. vp. AT.

Current activities and technical progress for the period July through September 1975 are reported for three subtasks. Subtask A covers the technical direction for critical experiments and analysis as applicable to LMFBR commercial plants and the Clinch River Breeder Reactor Plant Benchmark Critical Experiments in ZPPR Assembly 4 and the CRBRP EMC. Subtask B is directed toward the development of LMFBR plant calculational methods that also can be used at the sites of the Clinch River Breeder Reactor to determine the reactor power distribution, reactivity and fuel status, and for consideration of alternative fuel and control management schemes. Subtask C is directed toward the development of nuclear design extrapolation techniques which will allow the extrapolation of nuclear design data from one LMFBR design to another, e.g. extrapolation of critical experiment data to LMFBR. (auth)

16294 (GEAP-14032-3) REFERENCE FUEL STUDIES FIRST SEMIANNUAL REPORT, FEBRUARY 1975–JULY 1975. (General Electric Co., Sunnyvale, Calif. (USA). Fast Breeder Reactor Dept.). Aug 1975. Contract AT(04-3)-893. 40p. AT.

Research progress is reported for the following subtasks: (1) fuel rod chemistry and thermodynamics; and (2) in-reactor behavior of reference structural materials. (JWR)

16295 (JUL-Conf-14, pp 55-65) KALKAR NUCLEAR POWER PLANT. Koehler, M. (INTERATOM, Bensberg, Ger.). Jan 1975. (In German)

From meeting of the working group of KTG and the Nuclear Research Establishment; Juelich, F. R. Germany (12 Nov 1974).

In fuel elements for LWR, HTR, SNR, and GSB.

In a review of the characteristics of this sodium-cooled reactor, the topics discussed are the effects of Na properties on the design of the heat transfer system, reactor tank and fuel element handling, and the organization and status of the project. (JSR)

16296 (JUL-Conf-14, pp 67-79) CONCEPT OF THE 1000 MW(e) HELIUM COOLED FAST BREEDER REACTOR. Goetzmann, C. A. (Kraftwerk Union, Erlangen, Ger.). Jan 1975. (In German)

From meeting of the Working Group of KTG and the Nuclear Research Establishment; Juelich, F. R. Germany (12 Nov 1974).

In fuel elements for LWR, HTR, SNR, and GSB.

In a review of this concept the topics considered are the criteria used for the selection of this system, design data, and safety problems. (JSR)

16297 (JUL-Conf-14, pp 133-146) DESIGN REQUIREMENTS OF LMFBR FUEL ELEMENTS. Mayer, H.; Spenke, H. (INTERATOM, Bensberg, Ger.). Jan 1975. (In German)

From meeting of the Working Group of KTG and the Nuclear Research Establishment; Juelich, F. R. Germany (12 Nov 1974).

In fuel elements for LWR, HTR, SNR, and GSB.

In a review of the design requirements the topics considered are the system requirements and development status, status of the fuel concept, design, and fabrication methods for the SNR-300, and proceeding from the prototype to the full-scale plant. (JSR)

16298 (JUL-Conf-14, pp 147-159) DESIGN REQUIREMENTS OF GCFR FUEL ELEMENTS. Jung, W. (Kraftwerk Union AG, Erlangen, Ger.); Krug, W. Jan 1975. (In German)

From meeting of the Working Group of KTG and the Nuclear Research Establishment; Juelich, F. R. Germany (12 Nov 1974).

In fuel elements for LWR, HTR, SNR, and GSB.

In a review of the design requirements, the topics considered are fabrication of the fuel elements, pressure equalization system, and heat engineering design. (JSR)

16299 (JUL-Conf-14, pp 211-224) STATUS AND LONG-RANGE GOALS OF LMFBR FUEL ELEMENT DEVELOPMENT. Karsten, G. (Gesellschaft fuer Kernforschung mbH, Karlsruhe, Ger.). Jan 1975. (In German)

From meeting of the Working Group of KTG and the Nuclear Research Establishment; Juelich, F. R. Germany (12 Nov 1974).

In fuel elements for LWR, HTR, SNR, and GSB.

Present studies have concentrated on the selection of the canning material and the behavior of oxide fuels. Long-term goals include the investigation of carbide fuels. (JSR)

16300 (JUL-Conf-14, pp 225-242) STATUS AND GOALS OF GCFR FUEL ELEMENT DEVELOPMENT. Stehle, H. (Kraftwerk Union, Erlangen, Ger.); Krawczynski, S. Jan 1975. (In German)

From meeting of the Working Group of KTG and the Nuclear Research Establishment; Juelich, F. R. Germany (12 Nov 1974).

In fuel elements for LWR, HTR, SNR, and GSB.

A review is given of the development difficulties, status of the technological development, status of the irradiation studies, and fuel element development program for GCFR demonstration power plants. (JSR)

16301 (JUL-Conf-14, pp 281-293) CLOSING THE NUCLEAR FUEL CYCLE IN THE LMFBR. Ochsenfeld, W.; Schroeder, R. (Gesellschaft fuer Kernforschung mbH, Karlsruhe, Ger.). Jan 1975. (In German)

From meeting of the Working Group of KTG and the Nuclear Research Establishment; Juelich, F. R. Germany (12 Nov 1974).

In fuel elements for LWR, HTR, SNR, and GSB.

The status and pending R and D work on the reprocessing of fast breeder fuel elements are reviewed. The reprocessing technology is discussed with a consideration of the following steps or problems: chopping/slicing, separation of the oxide fuel from the canning material, voloxidation, dissolution, off-gases, extraction, and Pu loss. (JSR)

16302 (JUL-Conf-14, pp 295-311) CLOSING THE NUCLEAR FUEL CYCLE: TECHNOLOGY AND STRATEGY, GCFR. Meyer, L. (General Atomic Europe, Zurich). Jan 1975. (In German)

From meeting of the Working Group of KTG and the Nuclear Research Establishment; Juelich, F. R. Germany (12 Nov 1974).

In fuel elements for LWR, HTR, SNR, and GSB.

The topics considered are: the present phase of nuclear economy, breeding ^{233}U, HTR with pure ^{233}U charge, fast breeder plus HTR without external fissile supply, and economics of ^{233}U breeders. (JSR)

16303 (KFK-1275/2) FAST BREEDER PROJECT. Second Quarterly Report, 1975. Hueper, R. (comp.). (Kernforschungszentrum Karlsruhe (F. R. Germany)). Oct 1975. 215p. (In German). (EUR-5205d). Dep. NTIS (US Sales Only) $8.75.

Progress is reported in the areas of fuel rod development, material studies, corrosion tests, reactor kinetics, and safety and instrumentation (DG)

16304 (KFK-2174) HEAT REMOVAL EXPERIMENTS ON AN SNR FUEL ELEMENT USING A SODIUM FILLED TRANSPORT CONTAINER. Pruessmann, M.; Raepple, B.; Weinert, E. (Kernforschungszentrum Karlsruhe (F. R. Germany). Abt. Reaktorbetrieb und Technik). Aug 1975. 155p. (In German). Dep. NTIS (US Sales Only) $7.75.

Experiments are described which were made with an electrically heated fuel element dummy of the SNR-300 type in a transport container with sodium as the coolant. The thermal power removable in this way is represented for different operating conditions and the results are compared with that of other experiments and calculations. The investigations are significant for handling and transportation of irradiated fuel elements. By contrast with mere heat conduction, the experiments are characterized by a considerable improvement in heat transport through natural convection taking place in sodium, the heat transmission being improved by up to two powers of ten as compared to mere heat conduction. (auth)

16305 (LA-6048-PR) EXAMINATION OF FAST REACTOR FUELS, FBR ANALYTICAL QUALITY ASSURANCE STANDARDS AND METHODS, AND ANALYTICAL METHODS DEVELOPMENT-IRRADIATION TESTS. Progress Report, April 1-June 30, 1975, and FY 1975. Baker, R. D. (comp.). (Los Alamos Scientific Lab., N. Mex. (USA)). Sep 1975. Contract W-7405-Eng-36. 19p. Dep. NTIS $4.00.

The development tests and examination equipment and new analytical chemistry techniques for examining irradiated LMFBR fuel pins are described. Quality assurance requirements for FFTF materials and components are presented. The development of a fuel burnup measurement method and the development of a fuel composition determination method are reviewed. (DCC)

16306 (LA-6114) CHIT: A COST ACCOUNTING PROGRAM FOR POSTIRRADIATION EXAMINATIONS OF FAST BREEDER REACTOR MATERIALS. Phillips, J. R.; Dowler, K. E. (Los Alamos Scientific Lab., N. Mex. (USA)). Sep 1975. Contract W-7405-Eng-36. 32p. Dep. NTIS $4.00.

CHIT is the Los Alamos Scientific Laboratory's cost accounting computer program for nondestructive and destructive examinations of irradiated fuel pins. The program allows immediate retrieval of fuel pin examination information and provides itemized listings for completed and projected fuel pin examinations, detailed cost accounting summaries for each investigator, fuel pin examinations during a specified time interval, and various subsets of the information. CHIT has been in successful operation for the past two years, providing precise information on cost accounting more efficiently than possible with a manual technique. (auth)

16307 (LA-6155-PR) EXAMINATION OF FAST REACTOR FUELS, FBR ANALYTICAL QUALITY ASSURANCE STANDARDS AND METHODS, AND ANALYTICAL METHODS DEVELOPMENT-IRRADIATION TESTS. Progress Report, July 1-September 30, 1975. Baker, R. D. (comp.). (Los Alamos Scientific Lab., N. Mex. (USA)). Nov 1975. Contract W-7405-Eng-36. 12p. Dep. NTIS $4.00.

Research directed toward the examination and comparison of the effects of neutron irradiation on LMFBR fuel materials and toward the development of analytical quality assurance standards is reported. (JWR)

16308 (ORNL-TM-4936) LMFBR SPENT FUEL TRANSPORT: SINGLE ASSEMBLY HEAT TRANSPORT TEST. Klima, B. B. (Oak Ridge National Lab., Tenn. (USA)). Oct 1975. 103p. AT.

The Single Assembly Heat Transport Test Facility operating experience and test data are presented. This facility was set up to test the heat transport of a simulated LMFBR single fuel assembly consisting of 217 stainless steel tubes each of which was individually wrapped with 0.091-in.-diam wire. This assembly failed and was replaced by an assembly with 0.060-in.-wire wrapping. Heat transport was tested using sodium, helium and argon gases, Dowtherm A, and a vacuum. (auth)

16309 (ORNL-tr-4004) ONE YEAR OF PHENIX OPERATION. Conte, F. (CEA Centre de Marcoule, 30 - Bagnols-sur-Ceze (France)). 1975. Translated by M. Gerrard from a French Report. (CONF-750411-84). 19p. Dep. NTIS $4.25.

From European nuclear conference; Paris, France (21 Apr 1975).

The operations carried out since the first coupling of the Phenix Station to the grid on Dec. 13, 1973 are described. The last of the tests before putting into service, interspersed with periods of work and which were terminated July 14, 1974, are also described. From this latter date, the system was in use with developments taking place without major incident. This chronological description is accompanied by diagrams for times up until the end of March 1975, production statistics, main operating variables at different states, and a summary of the incidents that have occurred during use. The chief subassemblies of the station are reviewed with details of possible incidents, modifications made, and partial conclusions that can be drawn. In particular, problems of fuel, block reactor structures, sodium pumps, clad rupture detection, steam generators, sodium circuits, and energy production installations are enumerated. In general, performance of the installation and values predicted have been in good agreement. Fuel handling was the objective of a special study, rather brief because of the few incidents encountered. The handling techniques used are described chronologically and the modifications introduced are reviewed. Dismantling and transfer in the processing plant of the first irradiated fuels are indicated. (auth)

16310 (RT/ING-(75)11) FULL SCALE TESTS AND THERMAL DESIGN CORRELATIONS FOR COILED ONCE-THROUGH STEAM GENERATORS. Campolunghi, F.; Cumo, M.; Ferrari, G.; Palazzi, G. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Jun 1975. 25p. Dep. NTIS (US Sales Only) $3.50.

Full scale heat transfer tests have been performed in a coiled once-through steam generating tube (d/sub tube/ equals 0.0155 m, d/sub coil/ equals 0.836 m), with subcooled water at inlet and superheated steam at outlet. Pressure (p) ranges from 80 to 170 bar, specific mass flowrate (G) from 1,000 to 2,500 kg/m^{2}sec,

surface heat flux (q") from 10 to 30 x 10^4 W/m^2, q"/G ratios have been kept almost constant, close to a typical value for LMFBR's steam generators: q"/G approximately equal to 0.13 KJ/kg. It has been deduced that for q"/G less than 0.13 KJ/kg no DNB does occur. Designers may so account for a boiling length extended up to 100 percent quality. Along this length (an important portion of steam generators) a mean boiling heat transfer coefficient is suggested: Dirac constant/sub b/ equals 11,226 $q''^{0.6}$, $e^{0.0132}$ anti p [W/m^2 ^{0}C] within a +- 30 percent error margin. Internal and external side heat transfer coefficients, in the superheated steam region of the coil, may differ up to 100 percent and more. (auth)

16311 (TNO-LMEC-9) CENTRAL TECHNICAL INSTITUTE (TNO): MONTHLY REPORT, OCTOBER 1974. (Nijverheidsorganisatie TNO, Apeldoorn-Zuid (Netherlands). Centraal Technisch Instituut TNO). 1974. Translated from Dutch Report. 20p. Dep. NTIS $3.50.

Work performed under United States–TNO Technical Exchange Program.

The installation showed a high availability during the period. Thermally coupled operation was 90%. In this period the steam generator was sometimes 100% loaded. However, tests did not turn out to be possible under these conditions, in connection with the faulty operation of the reducing devices E 302 and E 303. Stability tests were conducted with loads of less than 60% on the steam generator. Bellows leakages again appeared in the case of some valves in the sodium system. Emergency repairs were conducted on this. (auth)

16312 (TNO-LMEC-10) CENTRAL TECHNICAL INSTITUTE (TNO): MONTHLY REPORT, NOVEMBER 1974. (Nijverheidsorganisatie TNO, Apeldoorn-Zuid (Netherlands). Centraal Technisch Instituut TNO). 1974. Translated from Dutch Report. 23p. Dep. NTIS $3.50.

Work performed under United States–TNO Technical Exchange Program.

The installation was in operation up to and including the 47th week and showed thereby a high degree of availability (90%). In the 48th week, the installation was taken out of operation in connection with various repairs. The first three weeks of this period, the following experiments were conducted, among others, on the steam generator: minor difficulties with both 60% as well as 30% load; and stability test under low pressure. The conducting of the minor difficulties program with a high load was not possible in connection with the not completely satisfactory operation of the reduction installation of the steam system. (auth)

16313 (TNO-LMEC-12) CENTRAL TECHNICAL INSTITUTE (TNO): FIRST QUARTERLY REPORT, 1975. (Nijverheidsorganisatie TNO, Apeldoorn-Zuid (Netherlands). Centraal Technisch Instituut TNO). 1975. Translated from Dutch Report. 9p. Dep. NTIS $3.50.

Work performed under United States–TNO Technical Exchange Program.

The completion of the helical-tube steam generator is described. The test program was concluded with a safety program "isolation on steam side and blowdown." In preparation for cleaning by vacuum distillation, an attempt was made on an empirical basis to determine whether the steam generator can be raised to the temperature necessary for vacuum distillation using a trace heating system after hot dumping. The result of the experiment was satisfactory. Some leak measurements were performed on the sodium-side isolation valve and temperature measurements under various conditions on the frozen seal. (auth)

16314 (WARD-CR-3045-10) CORE RESTRAINT DEVELOPMENT. Quarterly Progress Report for Period Ending August 31, 1975. Thompson, D. C. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Dec 1975. Contract E(11-1)-3045. 18p. Dep. NTIS $3.50.

Progress is reported in the areas of three-dimensional development tests, simulated fuel assemblies, load measurement assemblies, insertion/withdrawal fixture, and facility modification for full core tests. (DG)

16315 (WARD-OX-3045-6(Vol.2)) 11:1 SCALE ROD BUNDLE FLOW TESTS: PARTS 8 AND 9. Roidt, R. M.; Vegter, B. J. Pechersky, M. J.; Markley, R. A.; Sherba, P. S. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Oct 1975. Contract E(11-1)-3045. 104p. AT.

The tests include measurements of velocities downstream of blocked subchannels in a model LMFBR rod bundle and measurements of effects of rod bowing on the subchannel flow rate in a model rod bundle. (JWR)

16316 ADVANCED REACTORS: PHYSICS, DESIGN, AND ECONOMICS. Proceedings of the International Conference Held at Atlanta, Georgia, September 8–11, 1974. Kallfelz, J. M.; Karam, R. A. (eds.). Oxford; Pergamon Press Ltd. (1975). 854p. (CONF-740903–). $30.00.

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974).

Sixty papers are included. Each paper has been separately abstracted and indexed, with fifteen papers listed in previous issues of NSA under Conference No. 740903. (DG)

For abstracts of individual papers see: 15913, 15914, 16231, 16270–16273, 16317–16346, 16373–16375, and 16487–16491.

16317 FRENCH PROGRAM OF ADVANCED REACTORS. Clouet d'Orval, C.; Brisbois, J.; Schwartz, J. P.; Mougniot, J. C. (Commissariat a l'Energie Atomique, Paris). pp 2-18 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

Performance and core design concepts are discussed for commercially viable LMFBR and HTGR systems under development in France. (DG)

16318 PROGRESS OF FAST BREEDER REACTOR AND HEAVY WATER REACTOR DEVELOPMENT IN JAPAN. Takeda, E.; Sawai, S.; Inoue, T.; Miyawaki, Y. (Power Reactor and Nuclear Fuel Development Corp., Tokyo). pp 19-32 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

The present status of JOYO and MONJU (LMFBR's) and of JATR (HWLWR) are briefly reviewed. (DG)

16319 STATUS OF THE FAST REACTOR DEVELOPMENT IN THE USSR. Orlov, V. V.; Kochetkov, L. A. (Inst. of Physics and Power Engineering, Obninsk, USSR). pp 55-67 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

A brief description of the state-of-the-art in development of fast sodium-cooled reactors in the USSR is presented. Their place in future atomic power engineering, prospects, and problems of future sodium reactors of the next generation are discussed. (auth)

16320 CURRENT STATUS OF THE U. S. FAST BREEDER REACTOR DEVELOPMENT PROGRAM. Nemzek, T. A.; Cunningham, G. W. (Energy Research and Development Administration, Washington, DC). pp 68-86 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

A brief description is given of the program for the development of the Liquid Metal Fast Breeder Reactor (LMFBR). Several other breeder concepts are under study by the Division of Reactor Research and Development including the Gas-Cooled Fast Breeder Reactor (GCFBR), and the Molten-Salt Breeder Reactor (MSBR). The most recent milestone reached in the U. S. breeder program is initiation of work on the Clinch River Breeder Reactor, which has evolved as a partnership among the AEC, Commonwealth Edison and the Tennessee Valley Authority. It will be the first breeder demonstration plant, have a capacity of 380 MWe, and represent financial contributions in excess of $240 million from about 350 investor and publicly-owned electric utilities. (auth)

16321 EXAMINATION OF LMFBR POWER AND RESOURCE COST PROJECTIONS. Strauch, S. (Energy Research and Development Administration, Washington, DC); Fletcher, J.; Bennett, L. pp 90-104 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

Mining large quantities of uranium from low grade ores may be required if the LMFBR is not introduced at an early date. The environmental and economic costs of obtaining uranium from the low grade ores would be high. With the LMFBR, the utility industry can be essentially independent from mined uranium by the year 2020 and have lower average nuclear power plant fuel cycle costs. (auth)

16322 ECONOMIC OUTLOOK FOR COMMERCIAL LMFBR'S. Horst, K. M.; Murphy, P. M.; Palmer, R. S. (General Electric Co., Sunnyvale, CA). pp 105-120 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

The LMFBR can significantly expand domestic energy resources if it can economically compete with conventional power plants. To assure this competitive position the LMFBR must meet projected cost targets. Four ingredients are believed necessary to meet these targets: (1) large plant sizes must be used, (2) multiple plant construction must be achieved, (3) the design must utilize advanced technology relative to that of the U. S. Liquid Metal Fast Breeder Reactor Demonstration Plant, and (4) commercial organization structure and practices must be followed. The realization of these cost-reductions will allow the breeder to compete favorably with alternative energy sources. Only then will the breeder be deployed widely enough to fulfill its promise of providing abundant electrical energy from low-cost domestic reserves. (auth)

16323 OPTIMAL DESIGN OF LARGE LMFBR CORES. Dyos, M. W. (Westinghouse Electric Corp., Madison, PA). pp 121-124 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

A review is given of the procedures involved in developing an optimal design for LMFBRs. Specifically a discussion is given of the interaction of the various engineering disciplines which must be considered in acheiving an optimum design. (auth)

16324 ECONOMIC AND NUCLEAR PERFORMANCE CHARACTERISTICS OF 500-MW(e) OXIDE, CARBIDE, AND NITRIDE LMFBRs. Caspersson, S. A.; Noyes, R. C.; Vitti, J. A. (Combustion Engineering, Inc., Windsor, CT). pp 125-134 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

An evaluation of the nuclear and economic performance characteristics of 500-Mw(e) oxide, carbide, and nitride LMFBRs is presented. Comparative assessments of the three fuels show that significant economic and doubling time advantages exist for carbide fuel over both oxide and nitride fuels. Individual reactor core designs, each utilizing one of the three fuels and incorporating near-term design and performance conditions, were evaluated. A principal design criterion for each of the cores was a peak clad damage fluence limit of 1.8×10^{23} n/cm^2 (E > 0.1 MeV). This value was selected to accommodate a fast neutron fluence induced volumetric stainless steel swelling limit of 10%. Even though the fluence criterion penalizes the maximum heavy metal discharge burnups of the carbide and nitride fuels relative to oxide fuel, the advanced concepts outperform the oxide. A significant economic advantage exists for carbide fuel over nitride as a result of its better neutron economy. With near-term projections, the cost advantage of carbide fuel is 0.30 mills/kwhr over both the oxide and the nitride. In addition, the carbide core has a fissile doubling time less than one-half that of the oxide and 25% less than the nitride core. Long-term cost projections show the continued superiority of carbide fuel and an economic advantage of nitride over oxide fuel. It is concluded that, with present technology, carbide fuel is the best selection for commercial LMFBR application. (auth)

16325 FUEL ECONOMICS OF GCFR/HTGR SYMBOLIC SYSTEMS. Brogli, R.; Schlueter, G. (General Atomic Co., San Diego, CA). pp 135-143 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

One of the objectives of nuclear reactor development is to design reactors that will utilize the available fissile and fertile materials in the most effective way so as to ensure the long-term availability of low-cost nuclear fuel. To achieve this goal, it is shown that a combination of high-performance breeders and converters is required. The right combination of breeder and converter reactors leads to power systems that are self-sustaining systems. The objectives of designing such power systems are twofold: to recover the maximum amount of energy from a given amount of fuel and to minimize the energy-generating costs. The combined operation of a Gas-Cooled Fast Breeder Reactor (GCFR) with a thorium radial blanket and several U-233-fueled High-Temperature Gas-Cooled Reactors (HTGRs) is a self-sustaining power system that meets these objectives. Both reactors effectively utilize the fuel and ensure low energy-generating costs. Utilizing current oxide-fuel technology, the GCFR has a breeding ratio of 1.45. Further, the GCFR has potentially a low capital cost due to its relatively simple plant technology that is extrapolated from the HTGR. The extra breeding capacity, which is esentially the breeding gain, takes place in the radial blanket and is utilized to convert thorium to U-233 for HTGRs. Because the price of U-233 is expected to be higher than the price of plutonium, the GCFR fuel-cycle costs are expected to be 0.7 mill/kWh lower than for a similar breeder with a uranium blanket. (auth)

16326 IMPLICATIONS OF RECENT TRENDS ON LMFBR PERFORMANCE CHARACTERISTICS. Hardie, R. W.; Omberg, R. P.; Rothrock, R. B. (Hanford Engineering Development Lab., Richland, WA). pp 153-164 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

It is concluded that the breeding ratio of a 1000 MWe reactor based on a design of the FTR type is about 0.27 lower than that of the conceptual follow-on design. Approximately one-third of this drop is due to cross section changes and the other two-thirds is due to design decisions. These design decisions were conservative since information pertaining to stainless steel swelling and corrosion was limited when the FTR design was fixed. However, programs are currently under way to provide more information on swelling and corrosion rates; this information should allow the designer to increase the fuel volume fraction by reducing either the steel or sodium volume fractions. In addition, it may be possible to improve the doubling time in future oxide-stainless steel LMFBR core designs by techniques such as: increasing the smear density of the fuel, the development of a swelling or creep-resistant alloy, the use of fission gas vents, cold-end plenums, or other design features to reduce the amount of steel and sodium in the core. (auth)

16327 NEUTRON STREAMING IN GCFR-LATTICES: THEORY AND RESULTS. Eisemann, E. (Gesellschaft fuer Kernforschung, Karlsruhe, Ger.). pp 206-216 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

A theory is described to calculate correctly the leakage out of fast reactor lattices in the framework of the diffusion approximation, i.e. by definition of a direction dependent diffusion coefficient for the lattice. This coefficient can be determined as a generalization of the normal diffusion coefficient D without introducing further assumptions or simplifications. Only the geometrical configuration of the lattice has to be defined in addition. The anisotropy of the elastic scattering is taken into account explicitly up to the first moment. Above all, no cylindrization of lattice cells must be performed, a procedure which might be adequate for thermal reactors, but is doubtful for fast reactor lattices. The expression derived for the anisotropic diffusion coefficient D will – in the limit case of the homogeneous medium – reduce exactly to the usual expression used for D in the so-called "consistent Pl approximation". Results of reactor calculations show that the leakage out of typical GCFR cores is underestimated by approximately 3% in normal diffusion calculations with homogenized core zones. The examples considered indicate that this may have implications on reactor safety analysis for GCFR's as well as for the calculation of void reactivity in sodium cooled fast breeders. (auth)

16328 INFLUENCE FUNCTION ALGORITHMS FOR PREDICTING THREE-DIMENSIONAL POWER DISTRIBUTIONS AND CONTROL REACTIVITY WORTHS IN LMFBR PLANTS. Cowan, C. L. (General Electric Co., Sunnyvale, CA). pp 244-251 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

An influence function approach for predicting the three-dimensional power distributions and control reactivity worths in LMFBR plants has been formulated. Testing of the influence function approach has indicated that it is a simple, rapid and effective tech-

nique for carrying out three-dimensional calculations of the effects of control rod movements in a specified LMFBR system. (auth)

16329 CONTROL ROD INTERACTION EFFECTS IN SODIUM COOLED FAST REACTORS. Daughtry, J. W. (Westinghouse Hanford Co., Richland, WA); Meyer, J. F.; Travelli, A. pp 296-304 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

An experimental and analytical study was performed to investigate the magnitude of control rod interaction effects and to evaluate analytical methods for computing the worths of boron carbide absorber rods when large interaction effects are present. Experimental results are presented which show that abnormal rod configurations can produce a factor of two changes in rod worths. Computations of rod worths show good agreement with the experimental results. (auth)

16330 IMPACT OF EBR-II TESTS AND OPERATIONAL DATA ON ANALYSIS. Meneghetti, D.; Honekamp, J. R. (Argonne National Lab., IL). pp 329-343 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

The importance of EBR-II irradiation test and operational data impact on analysis is discussed and some recent advances and problems are reviewed. (auth)

16331 PHYSICS EVALUATION OF SOME DESIGN CHANGES IN THE EBR-II. Sehgal, B. R. (Argonne National Lab., IL). pp 344-353 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

Results are presented for the reactor physics analysis of the installation of a higher worth control rod system and a new type metal fuel loading for the EBR-II. (auth)

16332 CRITICAL EXPERIMENTS AT SNEAK IN SUPPORT OF FAST REACTOR DESIGN. Boehme, R.; Helm, F.; Pilate, S.; Pinter, M.; Scholtyssek, W. (Kernforschungszentrum, Karlsruhe, Ger.). pp 364-378 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

A series of critical experiments, SNEAK-9, is described which was designed to improve the prediction of neutronic, engineering and safety parameters for the German BeNeLux fast breeder prototype SNR. The possibilities of transferring the results obtained from SNEAK to the SNR are discussed in view of the experimental data available, their agreement with calculations, and the consistency of the results for different assemblies. (auth)

16333 IMPLICATIONS OF INTEGRAL EXPERIMENT DATA TO LMFBR DESIGN. Zolotar, B.; Beck, C.; Bohn, E.; Grasseschi, G.; Kaiser, R. E.; Kier, P.; Simons, G.; Yule, T. (Argonne National Lab., IL). pp 392-401 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

Experiments and calculations from a large variety of experiments have been examined to determine consistency and general trends. Particular attention was paid to basic parameters and to heterogeneity results which are necessary to make extrapolations to power reactor designs. (auth)

16334 PRESENT STATUS OF CROSS SECTION DATA OF THE FISSILE AND FERTILE ISOTOPES FOR FAST REACTORS. de Saussure, G.; Perez, R. B. (Oak Ridge National Lab., TN). pp 427-451 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

The status of the most relevant neutron cross sections for the design of fast breeder reactors is briefly reviewed. (auth)

16335 TESTING OF NUCLEAR DATA SETS USING PROTEUS GCFR LATTICE DATA. Richmond, R. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen); Ottewitte, E.; Oppenheim, C.; Barre, J. Y.; Behrenz, P.; Cerbone, R. G.; Jirlow, K.; Heer, W.; Seth, S.; Wydler, P. pp 513-522 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

Measurements of central reaction rate ratios and neutron spectra made in a typical gas-cooled fast reactor lattice have been used to check the predictions of a range of nuclear data sets. The results are discussed in relation to current target accuracies for fast breeder reactors. (auth)

16336 INTERNATIONAL BENCHMARK CALCULATIONS ON A TYPICAL 1000-MW(e) GAS-COOLED FAST BREEDER REACTOR. Oppenheim, C. (European Association for Gas-Cooled Breeder Reactor, Brussels); Cerbone, R. J. pp 523-530 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

A benchmark calculation has been made on a typical 1000-MW(e) Gas-Cooled Fast Breeder Reactor to check the sensitivity of calculated physics parameters to differences in cross-section sets and methods. Seven international groups participated in the benchmark calculations, with each group utilizing the data set currently in use for fast breeder reactor design in its respective country. The results indicate that predictions of neutron balance and breeding ratio for gas-cooled fast reactors with European and U. S. cross-section libraries are in good agreement. (auth)

16337 SENSITIVITY OF LMFBR DYNAMIC CALCULATIONS TO BASIC DATA SOURCES. Saphier, D.; Ilberg, D.; Yiftah, S. (Soreq Nuclear Research Centre, Yavne, Israel). pp 592-605 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

Cross section, delayed neutron, and fission product data from different basic data sources were used to perform a set of comparative calculations. Several fast cores were calculated by exactly the same procedure so that differences in the results were due to discrepancies in the data only. It is shown that discrepancies of up to 30% in the kinetic parameters result when different data sources are used. The discrepancy in the power excursion initiated by identical perturbations may differ by more than an order of magnitude according to the data source used and the perturbation which caused the transient. It is concluded that to perform reliable dynamic calculations for fast reactors, required in safety analysis, the discrepancies among the data should be clarified and the uncertainties further reduced. (auth)

16338 SENSITIVITY STUDIES OF THE BREEDING RATIO FOR THE CLINCH RIVER BREEDER REACTOR. Kallfelz, J. M. (Georgia Inst. of Tech., Atlanta); Williams, M. L.; Lal, D.; Flanagan, G. F. pp 606-619 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

Generalized perturbation theory has been used to investigate the sensitivity of the breeding ratio for the Clinch River Breeder Reactor to various cross section changes. Model studies to determine a one-dimensional model appropriate for the investigations are described. For a 26-group ENDF/B-III data set, curves which give the sensitivity of the breeding ratio to various fertile and fissile element cross sections are reported and discussed. An example of folding the sensitivity data with an ENDF/B covariance file is given. (auth)

16339 SENSITIVITY STUDIES OF THE EFFECTS OF NUCLEAR DATA UNCERTAINTIES FOR THE HIGHER PLUTONIUM ISOTOPES UPON FAST REACTOR DESIGN. McKnight, R. D. (Argonne National Lab., IL); LeSage, L. G.; Christensen, J. M. pp 620-629 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

The sensitivity of LMFBR design parameters to nuclear data uncertainties is investigated. Based on a review of the available cross section literature, the uncertainties in the cross sections of ^{240}Pu, ^{241}Pu, and ^{242}Pu, as well as ^{239}Pu and ^{238}U, are evaluated.

The effects of these cross section uncertainties upon reactor parameters are assessed by making uniform cross section adjustments within the range of uncertainties. The sensitivity calculations consider two methods of maintaining the system at critical: (1) by adjusting the core enrichment, and (2) by adjusting the amount of control in the core. The results of these sensitivity calculations are compared with target accuracies for calculation of reactor parameters. These sensitivities are further used to estimate the nuclear data uncertainties which would be allowable to meet the target accuracies. (auth)

16340 PHYSICS DESIGN OF GAS-COOLED FAST BREEDER REACTORS. Cerbone, R. J. (General Atomic Co., San Diego, CA). pp 635-649 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

The physics design of Gas-Cooled Fast Breeder Reactors is discussed in the context of the General Atomic 300-MW(e) GCFR Demonstration Plant. This is followed by a brief discussion of the design parameters for and breeding capabilities of commercial-size GCFR plants. (auth)

16341 NUCLEAR DESIGN OF THE CLINCH RIVER BREEDER REACTOR SYSTEM. Buhl, A. R. (Energy Research and Development Administration, Germantown, MD); Riley, D. R.; Dickson, P. W.; Doncals, R. A.; Greebler, P. pp 650-664 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903--.

The nuclear design of the Clinch River Breeder Reactor (CRBR) is proceeding on schedule and is consistent with the fundamental objectives of the first LMFBR (U, S_a) Demonstration Plant–namely: (1) safe, reliable, and efficient operation in a normal utility environment and (2) provide a demonstration of the breeding principle. The nuclear design is described by the following generic areas of interest: reactor system design; nuclear data, computation methods, and critical experiments; fuel-blanket management; control considerations; breeding characteristics; nuclear design impact on safety parameters; and core monitoring. (auth)

16342 FUEL AND BLANKET MANAGEMENT FOR THE CLINCH RIVER BREEDER REACTOR. Paik, N. C.; Doncals, R. A.; Lake, J. A. (Westinghouse Electric Corp., Madison, PA). pp 677-687 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

The CRBR core fuel and radial blanket management has been optimized within the constraints imposed by yearly refueling, the specified capacity factors, and the maximum allowable burnup limits. This is the initial optimization of the reference fuel management for CRBRP using detailed two-dimensional burnup calculations for each operating cycle. Individual cycle refueling schemes for the core fuel assemblies and the shuffling and refueling patterns for radial blanket assemblies have been arrived at within the reference CRBR constraints. Detailed two-dimensional analyses of the corresponding breeding ratios and the peak and average discharge burnups are presented. The breeding ratios during the transition cycles are shown to be significantly improved by the introduction of a constant transition feed enrichment for cycles 2 through 6. The effect on the CRBR breeding ratio of the FFTF type fuel versus an interim high breeding fuel assembly design has also been investigated for the first twelve transition cycles. Based on this fuel management study, fissile plutonium production and fissile mass flow out of CRBRP have been determined. (auth)

16343 START-UP AND INITIAL OPERATING EXPERIENCE OF PHENIX. Guillemard, B.; Le Marechal, T.; Caluzon, P.; Giraud, B. pp 747-771 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

The PHENIX 250 MW reactor reached nominal power on March 12, 1974. A description is presented of the startup tests which began at the end of 1972 and were completed at the end of May 1974. Phenix plant is now in its normal operational phase. Main results and encountered difficulties are reported. (auth)

16344 ANALYSIS OF THE INITIAL PHENIX THERMAL BALANCES. Ginier, R.; Gouriou, A.; Kayser, G.; Skok, J.; Coulon, P. pp 772-784 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford, Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

Main results obtained during the preparation of nominal power operation of Phenix are presented. They concern mainly the power and temperature distribution in the core. Comparisons are made with predicted values. Evaluations and comparisons of thermal heat balances obtained in the core and in the circuits are presented. (auth)

16345 RESULTS OF INVESTIGATIONS AND START-UP EXPERIENCE OF AN ATOMIC POWER PLANT WITH THE BN-350 REACTORS. Mitenkov, F. M.; Orlov, V. V.; Bagdasarpv, Yu. E. (Inst. of Physics and Power Engineering, Obninsk, USSR). pp 785-795 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

On July 16, 1973 in the town of Shevtchenko, Kazakh SSR, the power start-up of the first large-scale industrial atomic power plant with a fast reactor was carried out. The start-up of this plant follows almost 25 years of work in the USSR on fast breeders. Some results are given of investigations as well as of operation experience during the period of start-up and adjustment works and the first months after the power start-up at power levels up to 30%. These results show that all the equipment of the reactor plant itself and of sodium circuits is efficient, reliable, and easily controlled. At the same time, the period of start-up and adjustment works and the first period of operation have revealed a number of difficulties which hamper mastering of the plant. (auth)

16346 DESIGN OF CLINCH RIVER BREEDER REACTOR AND SELECTION OF BASIC PLANT PARAMETERS. Jacobi, W. W. (Westinghouse Electric Corp., Madison, PA). pp 796-821 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

The Clinch River Breeder Reactor is a 975 MWt sodium cooled fast breeder demonstration plant to be located in the TVA network on a site on the Clinch River near Oak Ridge, Tennessee. The reactor and primary loop portion of the three loop system are located within a 186-foot diameter containment building which also houses the necessary inert gas and inventory control equipment. Non-radioactive sodium from the intermediate heat exchangers exits containment through an intermediate building to a tornado-hardened steam generator building. The reference steam generator system consists of a combination of two evaporators and one superheater module per loop which operate in a forced recirculation mode to generate steam at 1450 psig/900°F. The reactor core consists of 198 fuel assemblies each containing 217 pins fueled with U-PuO_2. The reactor core is surrounded by 150 radial blanket assemblies containing depleted uranium. The reactor fuel assembly design is based on the assembly designed and developed for the Fast Flux Test Reactor (FFTF). The basic plant parameters were selected on the basis of attaining 1450 psig/900°F turbine throttle conditions and obtaining reasonable fuel burnup performance. The specific thermal/hydraulic and structural design conditions were selected by use of a statistical evaluation of plant margins which allow prediction of expected plant performance versus design performance. These predictions were then used to evaluate fuel performance objectives. (auth)

16347 ACTIVITIES OF NERATOOM. Atoomenerg. Haar Toepass.; 17: No. 10, 202-205(Oct 1975).

The Neratoom Group, which is responsible for technological research in the nuclear field, has been entrusted with the development and delivery of major sodium components for the German-Benelux SNR-300 project. (NL)

16348 ROUGH PASSAGE IN USA FOR FIRST BREEDER REACTOR. Norman, C. Nature (London); 257: No. 5526, 434-436 (9 Oct 1975).

The present status of the liquid metal fast breeder reactor (LMFBR) program in the USA is reviewed, including administrative and technical problems. This program is stated to be the highest priority energy research and development project supported by

public funds, estimated at present to cost more than 10 billion dollars, but it is beset by difficulties and criticism. (UK)

16349 A NEW SODIUM FLOWMETER FOR FUEL ELEMENTS IN NUCLEAR POWER STATIONS. Rainer, H. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bensberg/Koeln (F. R. Germany)). Siemens-Z.; 49: No. 5, 321-324(May 1975). (In German).

4 figs.

For the early detection of a failure in the primary coolant loop of a fast sodium-cooled reactor, not only the coolant outlet temperature but also the coolant flow have to be monitored. The eddy-current flowmeter for liquid sodium which has been developed for this task is described, and its mode of operation is explained. Also described are the design of the probe and the circuit arrangement of the measuring apparatus. The flowmeter has been tested in all its possible applications and is currently being used at several test facilities to simulate failures and incidents. (DE)

16350 BURST TESTS ON CORE MODELS OF THE SNR 300 REACTOR. Will, H. (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Reaktorentwicklung). KFK Nachr.; 7: No. 2, 14-18(Jul 1975). (In German).

5 figs.; 1 tab.; 5 refs.

The experimental arrangement and procedures are described and the experimental results are given and discussed. The 5 tests carried out with a natural-size model in a large water-tank showed a threshold value of 100 bar in the failure element. The behaviour of the core seems to depend mainly on its hydraulic properties. Even higher fuel charges did not bring about intolerable damage. (DE)

16351 THERMAL INSULATION. Birch, W.; Stuart, R. A.; Facer, R. I.; Durston, J. G. (to Nuclear Power Group Ltd., Risley (UK)). German(FRG) Patent 2,451,448/A/. 7 May 1975. 15p. (In German)

The thermal insulation is designed for the separation wall of a reactor core and for the heat exchanger of liquid metal cooled, especially sodium cooled, nuclear reactors. It consists of a layer of insulation blocks of high-grade steel or cell-forming or porous material. There are spaces between the blocks which are closed to the coolant flow with filling elements made of a heat-proof steel alloy or of sintered high-grade steel. The blocks are all single and rigidly fixed to the insulating wall. A membrane cover made of an endless sheet of stainless steel which is ribbed in right-angled division covers the block layer. It has a perforation which enables the entering of coolant in the space between it and the wall to be insulated. (DE)

16352 STATUS REPORT 1975 ON THE FAST BREEDER PROJECT. European Cooperation in the Development of Research Plants with Fast Breeder Reactors. Hueper, R. (Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter). At. Strom; 21: No. 7, 75-77(Jul 1975). (In German)

The annual report on progress of the German-Belgian-Netherlands Fast Breeder Project was given at Bensberg/Cologne on March 6, 1975. It emphasized the industrial aspects of the development. Technological advance as well as a more intense international cooperation have been achieved in many important fields. At the same time, construction of the prototype SNR 300 at Kalkar (Lower Rhine) has slowed down as a consequence of delays in licensing. (DE)

16353 UTILIZATION OF ROLLER BEARINGS IN SODIUM ENGINEERING. Kleefeldt, K. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Reaktorentwicklung). KFK Nachr.; 7: No. 2, 5-13(Jul 1975). (In German)

7 figs.; 2 tabs.; 8 refs.

Due to the excessive wear on steel in sodium-lubricated roller bearings, only periodically working roller bearings, e.g., in reactor charging machines, are of practical use. Experimental studies and their results are reported. (DE)

16354 UTILIZATION OF THORIUM IN A FBR/HTGR POWER PLANT. Brogli, R. H.; Schultz, K. R. Arch. Energiewirtsch.; 29: No. 7, 666-669(Jul 1975). (In German)

Some combinations of different types of nuclear power station are investigated with regard to optimum fuel utilization with the aim of optimizing the fuel cycle costs. The systems studied are combinations of: (1) GCFR with Th can + U-233 in a HTGR reactor, (2) GCFR with U can + HTGR using Pu, (3) LMFBR + HTGR using Pu. The ultimate goal is to find a system which is self-supporting with regard to fuel. (DE)

Research, Test, and Experimental Reactors

Refer also to abstracts 15385, 16305, 16332, 16335, 16393, and 16435.

16355 (AEC-tr-7295, pp 153-156) GAS-LOOP INSTALLATIONS WORKING ON DISSOCIATING HEAT-TRANSFER MEDIUM. Nesterenko, V. B.; Khorev, V. I.; Kremeshnyi, A. I.; Sokol'chik, V. A. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli I Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk, Inst. Yadernoj Ehnergetiki).

Two in-pile loop facilities are described for use in research with N_2O_4 as a heat transfer medium. One loop is intended for study of the radiation-thermal stability of N_2O_4, testing construction materials in N_2O_4, and heat transfer properties of N_2O_4 in a radiation environment. The other loop is designed for testing fuel assemblies in N_2O_4. (HDR)

16356 (AEEW-R-993) ISOTOPIC ANALYSIS OF HIGHLY IRRADIATED SAMPLES FROM BR3 CORE 2 ASSEMBLY 46 COMPARISON WITH WIMS D4 RESULTS. Gibson, I. H.; Sidell, S. M. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment). Feb 1975. 27p. Dep. NTIS (US Sales Only) $4.00. UK £1.00.

The isotopic composition of samples irradiated during two cycles in the BR3 Reactor has been calculated using WIMSD4, and compared with mass spectrometric measurements. The analysis has determined the irradiation of the samples at 55,000 MWd/t and 33,100 MWd/t. The agreement between calculation and measurement is very good, being on average better than 1% for U-235, U-238, Pu-239, Pu-240, and Pu-242. There is a 5% discrepancy on Pu-241 which may be due to error in calculation of decay, and of 4% in Pu/U ratio which could be due to an error in assessment of fuel temperature. Analysis of Am-241 indicates no serious error in its calculation. The irradiation of 55,000 MWd/t is the highest for which isotopic comparisons have been made in the UK. Irradiation estimates from analysis of Nd-148 and U-235 are in good agreement. (auth)

16357 (BNL-NCS-50451, pp 18-28) MONTE CARLO ANALYSIS OF TRX LATTICES WITH ENDF/B VERSION 3 DATA. Hardy, J. Jr. Mar 1975.

From proceedings of 238U resonance capture; Upton, New York, USA (18 Mar 1975).

In seminar on the ^{238}U resonance capture. (Brookhaven National Lab., Upton, N. Y. (USA)).

Four TRX water-moderated lattices of slightly enriched uranium rods have been re-analyzed with consistent ENDF/B Version 3 data by means of the full-range Monte Carlo program RECAP. The following measured lattice parameters were studied: ratio of epithermal-to-thermal U^{238} captures, ratio of epithermal-to-thermal U^{235} fissions, ratio of U^{238} captures to U^{235} fissions, ratio of U^{238} fissions to U^{235} fissions, and multiplication factor. In addition to the base calculations, some studies were done to find sensitivity of the TRX lattice parameters to selected variations of cross section data. Finally, additional experimental evidence is afforded by effective U^{238} capture integrals for isolated rods. Shielded capture integrals were calculated for U^{238} metal and oxide rods. These are compared with other measurements. (auth)

16358 (BNL-NCS-50451, pp 35-44) S/sub n/ ANALYSIS OF THE TRX METAL LATTICES WITH ENDF/B VERSION III DATA. Wheeler, F. J. (Aerojet Nuclear Co., Idaho Falls, ID). Mar 1975.

From proceedings of 238U resonance capture; Upton, New York, USA (18 Mar 1975).

In seminar on the ^{238}U resonance capture. (Brookhaven National Lab., Upton, N. Y. (USA)).

Two critical assemblies, designated as thermal-reactor benchmarks TRX-1 and TRX-2 for ENDF/B data testing, were analyzed using the one-dimensional S/sub n/-theory code SCAMP. The two assemblies were simple lattices of aluminum-clad, uranium-metal fuel rods in triangular arrays with D_2O as moderator and reflector. The fuel was low-enriched (1.3 percent ^{235}U), 0.387-inch in diameter and had an active height of 48 inches. The volume ratio of water to uranium was 2.35 for the TRX-1 lattice and 4.02 for TRX-2. Full-core S/sub n/ calculations based on Version III data were performed for these assemblies and the results obtained were compared with the measured values of the multiplication factors, the ratio of epithermal-to-thermal neutron capture in ^{238}U, the ratio of epithermal-to-thermal fission in ^{235}U, the ratio of ^{238}U fission to ^{235}U fission, and the ratio of capture in ^{238}U to fission in ^{235}U. Reaction rates were obtained from a central region of the full-core problems. Multigroup cross sections for the reactor calculation were obtained from S/sub n/ cell calculations with resonance self-shielding calculated using the

RABBLE treatment. The results of the analyses are generally consistent with results obtained by other investigators. (auth)

16359 (BNL-NCS-50451, pp 167-188) REACTIVITY AND REACTION RATE MEASUREMENTS IN U–D_2O LATTICES WITH COAXIAL FUEL. Pellarin, D. J.; Morris, B. M. (E. I. du Pont de Nemours and Co., Aiken, SC). Mar 1975.

From proceedings of ^{238}U resonance capture; Upton, New York, USA (18 Mar 1975).

In seminar on the ^{238}U resonance capture. (Brookhaven National Lab., Upton, N.Y. (USA)).

Material bucklings and reaction rate parameters were measured for heavy water (D_2O) moderated, uniform lattices in the exponential facility (SE-SP) at the Savannah River Laboratory (SRL). Two different slightly enriched, coaxial, uranium fuel assemblies were examined over a wide range of triangular lattice pitches in this study. Results of experiments were compared with RAHAB computations using ENDF/B-IV cross sections. The purpose of this work was to expand the experimental data base to include uniform lattices of coaxial fuel assemblies. Assembly geometry and fuel composition are summarized. Integral parameters are reported for inner and outer fuel separately, providing data for a more detailed and rigorous comparison with computation than previously available. 3 figures, 6 tables. (auth)

16360 (CEA-R-4686) MEASUREMENTS OF FAST ASSEMBLIES SPECTRA USING TIME OF FLIGHT METHOD. Duquesne, H.; Rotival, M.; Schmitt, A.; Allard, C.; de Keyser, A.; Hortsmann, H. (CEA Centre d'Etudes Nucleaires de Cadarache, 13–Saint-Paul-les-Durance (France)). Jul 1975. 183p. (In French). Dep. NTIS (US Sales Only) $8.50.

Measurements of neutron spectra made in fast subcritical assemblies HUG 3 and PHUG 3 (uranium-graphite and plutonium-graphite utilizing time of flight techniques are presented. The matrix was excited by the pulsed neutron source from the BCMN Linac beam impinging on a target of natural uranium. Details of the experimental procedure, safety studies, detector calibration and data reduction are given. 35 references. (auth)

16361 (CNLM-5215) PROGRAM COST ESTIMATE FOR LITHIUM-COOLED REACTOR DEVELOPMENT. Fiscal Years, 1964–1965. (Pratt and Whitney Aircraft, Middletown, Conn. (USA)). 21 Aug 1963. Contract AT(30-1)-2789. 30p. Dep. NTIS $4.00.

Declassified 3 Nov 1975.

As a result of the LCRE program reorientation, fabrication of the reactor experiment has been terminated. Certain portions of the supporting development program which are regarded as advancing the state-of-the-art as applied to refractory metal cooled reactors and supporting systems are being retained in support of the SNAP-50/SPUR program. (auth)

16362 (CNLM-5278) PROGRAM COST ESTIMATE FOR LITHIUM-COOLED REACTOR DEVELOPMENT. Fiscal Years, 1964–1965. (Pratt and Whitney Aircraft, Middletown, Conn. (USA)). 15 Oct 1963. Contract AT(30-1)-2789. 29p. Dep. NTIS $4.00.

Declassified 7 Nov 1975.

As a result of the LCRE program reorientation, fabrication of the reactor experiment has been terminated. Certain portions of the supporting development program which are regarded as advancing the state-of-the-art as applied to refractory metal-cooled reactors and supporting systems are being retained in support of the SNAP-50/SPUR program. (auth)

16363 (HEDL-TME-74-3(Vol.2)) HEDL QUARTERLY TECHNICAL REPORT, JULY, AUGUST, SEPTEMBER 1974. Volume 2. Fuels and Safety Engineering. Evans, E. A. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Oct 1974. Contract AT(45-1)-2170. 76p. AT.

Progress is reported in the areas of LMFBR fuels technology and FFTF component fabrication. Extensive data on FFTF component fabrication and testing are presented. (DG)

16364 (INR-1470/3/E/B) AVERAGING THE SIGNALS OF THE PULSED REACTOR IBR-2. Komor, Z. (Institute of Nuclear Research, Warsaw (Poland)). 1973. 14p. (In Polish). INIS.

A circuit for averaging the signals from 4 ionization chambers situated in different areas of the active zone of the pulsed reactor IBR-2 is presented. The principle of the circuit and the work of analog switches is shortly described. (auth)

16365 (INR-1470/9/11/R/A) CALORIMETRIC MEASUREMENTS OF HEAT REMOVAL FROM SPENT FUEL OF THE EWA-10 REACTOR. Moldysz, A.; Panta, P.; Polawski, W.; Szuta, M. (Institute of Nuclear Research, Warsaw (Poland)). 1973. 36p. INIS.

Measurements have been made of the afterpower of the fuel elements from about one hour to several weeks after shutdown of EWA-10 reactor, using a quasi-adiabatic calorimeter. The temperature rise of the fuel elements in air space has been correlated with the afterpower level. The heat power generation from the decay of fission products has been compared with the Untermayer-Weills formula results for the EWA-10 reactor operation cycle. The experimental results of the afterheat show satisfactory agreement with computational ones. (auth)

16366 (KFK-2199) IRRADIATION BEHAVIOR OF UAl_3–Al AND UAl_2–Al DISPERSION FUEL PLATES. Dienst, W.; Gausmann, G. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung). Oct 1975. 44p. (In German). Dep. NTIS (US Sales Only) $5.00.

UAl_3–Al and UAl_2–Al dispersion fuel plates were prepared and irradiated in a pressurized water loop of the FR 2 to give information on the chemical reaction of the UAl_x particles with the Al matrix and on the swelling of the fuel plates by fission products, particularly by fission gas. After irradiation, the fuel plates did not show cladding failures by blister or crack formation in any case which could be attributed to the irradiation behavior of the fuel. Swelling of the fuel plates was examined by immersion density and thickness measurement. The results show that Al-base dispersion fuels containing UAl_3 or UAl_2 are suited for high burnups in research reactors. (auth)

16367 (LFEN-NI-85-a) RADIOMETRY IN A NUCLEAR RESEARCH REACTOR. Oliveira, J. M. C. (Junta de Energia Nuclear, Sacavem (Portugal). Lab. de Fisica e Engenharia Nucleares). 1975. 57p. (In Portuguese). INIS.

6 figs., 4 tables.

Essential aspects of radiometry in a nuclear research reactor are subjected to a close examination. Fundamentals of radiation detection are recalled after the finality of the present work has been established and the parameters involved have been defined. In the chapter concerning radiation detectors, main types commonly used during nuclear reactor operation are subjected to review, emphasising their working principles and also their field of application. The paper concerns also some practical considerations, referring to widely used neutron and gamma detectors in a nuclear reactor. Finally, a reference is made about measuring methods for neutron flux density and fluence, thermal neutron flux density on a continuous basis and absorbed dose. (INIS)

16368 (LIB/Trans-566) PRESENT STATUS OF RESEARCH REACTOR ENGINEERING IN ARGENTINA. Elder, E. J. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). May 1975. Translation by J. G. Wilson of pp 41-59 from IAEA-146. 17p. Dep. NTIS (US Sales Only) $4.50.

A description is presented of what has already been done to develop nuclear engineering in Argentina through the construction of research reactors. The research reactors currently in operation or under construction and the associated experimental facilities are described, reference being made to the purposes for which they are used and the problems of operation, maintenance and experiment co-ordination involved in trying to achieve optimum utilization. The critical assemblies RA-0 and RA-2, which were built mainly for parameter studies in connection with the design of reactors RA-1 and RA-3 respectively, are described, and an account is given of the principal measurements performed with these critical assemblies. The author describes the reactors RA-1 (150 kW) and RA-3 (8 MW), their experimental facilities, and the organizational aspect of their operation. Associated problems of nuclear fuel supply and the question of fuel reprocessing in Argentina are discussed. Mention is made of the zero-power reactor RA-4, which is being used for teaching, and of the preliminary plans for a high-flux thermal reactor. The 100-W thermally-driven fast reactor currently in the initial stages of construction is also described. (auth)

16369 (ORO-3346-173, p 24) RESEARCH WITH FAST NEUTRONS FROM THE GEORGIA TECH REACTOR. 31 Oct 1975.

In nuclear and x-ray spectroscopy with radioactive sources. Eleventh annual progress report, February 1, 1975–January 31, 1976. (Georgia Inst. of Tech., Atlanta (USA). School of Chemistry).

Progress in research with fast neutrons from the Georgia Tech reactor using ^6LiD as a source of 14 to 15 MeV neutrons is reported. (SDF)

16370 (ORNL-4865) FISSION PRODUCT BEHAVIOR IN THE MOLTEN SALT REACTOR EXPERIMENT. Compere, E. L.; Kirslis, S. S.; Bohlmann, E. G.; Blankenship, F. F.; Grimes, W. R. (Oak Ridge National Lab., Tenn. (USA)). Oct 1975. Contract W-7405-eng-26. 143p. Dep. NTIS $7.60.

Essentially all the fission product data for numerous and varied samples taken during operation of the Molten Salt Reactor Experiment or as part of the examination of specimens removed after particular phases of operation are reported, together with the appropriate inventory or other basis of comparison, and relevant reactor parameters and conditions. Fission product behavior fell into distinct chemical groups. Evidence for fission product behavior during operation over a period of 26 months with ^{235}U fuel (more than 9000 effective full-power hours) was consistent with behavior during operation using ^{233}U fuel over a period of about 15 months (more than 5100 effective full-power hours). (auth)

16371 (ORNL-TM-5216) BULK SHIELDING FACILITY QUARTERLY REPORT, APRIL, MAY, AND JUNE OF 1975. Hurt, S. S. III; Lance, E. D.; Thomas, J. R. (Oak Ridge National Lab., Tenn. (USA)). Jan 1976. Contract W-7405-eng-26. 41p. Dep. NTIS $5.00.

The BSR operated at an average power level of 1,722 kw for 37.10 percent of the time during April, May, and June. Water-quality control in both the reactor primary and secondary cooling systems was satisfactory. The BSR was operated at low and variable power during this quarter for 91,566 hours as part of the training programs for nuclear engineering students from the University of Tennessee and Mississippi State University. The PCA was also used in the above-mentioned training programs and was operated on seven occasions when the University of Kentucky or Mississippi State University students actively participated in training laboratories. (auth)

16372 THE ROLE OF THE TEST REACTOR IN EXPANDING THE OPERATIONAL LIMITS. Knudsen, K. D. (Organization for Economic Co-Operation and Development, Halden (Norway). Halden Reactor Project). Nucl. Eng. Des.; 33: No. 2, 196-204 (Sep 1975).

In the case of established reactor designs, such as light water reactors, (LWR), test reactors are valuable in learning more about specific operating details. For establishing the merits of completely new concepts, the scope of test reactors will naturally be wider. (NL)

16373 EUROPEAN OXIDE MEASUREMENTS IN THE ENGINEERING MOCKUP CRITICAL ASSEMBLY OF THE FAST TEST REACTOR. Pond, R. B.; Travelli, A.; Robinson, W. R.; Armani, R. J.; Beitel, J. C. (Argonne National Lab., IL). pp 305-314 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

Worth measurements of Eu_2O_3 and B_4C have been made at the location of a peripheral shim rod, of a control rod, and of a safety rod in the Engineering Mockup Critical (EMC) Assembly of the Fast Test Reactor (FTR). The worths were measured as a function of the volume fraction of control material in the rods over a range from 4 to 32 percent. The measurements indicate that europia is approximately equivalent to natural boron carbide on a reactivity worth per unit volume basis. Calculation of the worths and comparison with the experimental results have also been performed. (auth)

16374 EVALUATION OF APPR ASSEMBLY 3 SODIUM VOID EXPERIMENTS. McFarlane, H. F.; Lineberry, M. J.; Simons, G. G.; Beck, C. L.; Amundson, P. I. (Argonne National Lab., IL). pp 402-411 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

Results are reported of benchmark sodium void experiments and analyses in the ZPPR assembly 3. Comparison of neutronics experiments and analyses in the reference and voided cores are also included. (auth)

16375 ZPPR-4 DEMO CRITICALS PROGRAM. LeSage, L. G. (Argonne National Lab., Idaho Falls, ID); Amundson, P. I.; Carpenter, S. G.; McFarlane, H. F.; Lineberry, M. J.; Stewart, S. L.; Hitchcock, J. T. pp 412-421 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

The ZPPR-4 critical assembly was designed to be similar to the Clinch River Breeder Reactor Plant (CRBRP) design in overall shape, configuration and region-average compositions. A four phase program, directed at design input to the CRBRP, blanket performance, blanket fissile buildup effects, full-core breeding performance and plutonium isotopic effects is described. Experimental results for reaction rate distributions in the blanket, control rod and rod group worths and plutonium isotopic effects are discussed. (auth)

16376 RELEASE AND DETECTION OF FISSION PRODUCTS FROM DEFECTIVE FUEL RODS IN THE HSD-LOOP OF THE FR2. Jacobi, S. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Reaktorentwicklung). KFK Nachr.; 7: No. 2, 19-27(Jul 1975). (In German)

10 figs.; 3 tabs.; 8 refs.

Following a description of the loop, its construction and operation, a method of detection of delayed neutrons from fission products and fission material as well as of radioactive fission gases in the coolant using γ-spectroscopy is described. The experimental findings are presented and discussed. (DE)

16377 THRESHOLD DETECTOR MEASUREMENTS OF FAST NEUTRON SPECTRA IN A TRIGA REACTOR WITH APPLICATION OF A NEW UNFOLDING METHOD. Rantanen, E.; Routti, J. T.; Baers, B. (Helsinki Univ. of Technology, Otaniemi (Finland). Dept. of Technical Physics). Atomkernenergie; 26: No.2, 103-106(1975).

4 figs.; 3 tabs.; 12 refs.

Measurements of fast neutron spectra in the FiR-1 reactor of Triga Mark II type are reported. Activation detectors with threshold energies in the MeV-energy range are used and a new unfolding method of generalized least squares type is employed in the interpretation of their results. (DE)

16378 ACOUSTIC MEASURING METHODS AT THE KNK I REACTOR. Rohrbacher, H. A.; Aberle, J.; Bartholomay, R. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Reaktorentwicklung). KFK Nachr.; 7: No. 2, 1-4(Jul 1975). (In German)

7 figs.

Acoustic measurements have been carried out at the KNK reactor for the past two years with the purpose of developing sound-analytic methods for the early detection of failures in the coolant loop, e.g., sodium boiling, oscillations in the subassemblies, and irregularities in the running of the pumps. The reduction of the conventional individual instrumentation with the aid of an integral acoustic system is a project of increasing importance. (DE)

Production and Materials Testing and Processing Reactors

16379 (LIB/Trans-589/590) SILOE SAFETY REPORT. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). Aug 1975. Translation by A. P. Marks of Chapters 2 and 5 from CEA-2307. 36p. Dep. NTIS (US Sales Only) $5.00.

A description is given of the SILOE reactor including fuel elements, reactor core, reactor cooling system and the ventilation of the reactor hall and extraction of gaseous effluents. (AT)

Propulsion and Package Reactors

Refer also to abstracts 15173 and 16361.

16380 (CNLM-148) ALL NUCLEAR SUPERSONIC POWERPLANT PERFORMANCE ONE SOLID FUEL REACTOR. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 1961. 3p. Dep. NTIS $3.50.

Declassified 12 Jan 1976.

Specifications for a supersonic nuclear powered aircraft are listed. (DCC)

16381 (CNLM-383) SUGGESTED PRELIMINARY DESIGN PROGRAM FOR PWAR-11. Dickson, J. A. (Pratt and Whitney Aircraft, Middletown, Conn. (USA)). 25 Nov 1957. 6p. Dep. NTIS $3.50.

12 Jan 1976.

Preliminary design specifications for a lithium-cooled aircraft reactor are presented. (JWR)

16382 (CNLM-865) REQUEST FOR PHYSICS ANALYSIS. Woods, T. J. (Pratt and Whitney Aircraft, Middletown, Conn. (USA)). 24 Jun 1958. 4p. Dep. NTIS $3.50.

Declassified 12 Jan 1976.

The needs for analytical physics calculations for rocket reactor concepts are specified. The concepts include a graphite hydrogen cooled reactor and a fast W-UO_2 reactor. (JWR)

16383 (CNLM-871) REACTOR RESEARCH AND DEVELOPMENT PROGRAM. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 26 Jun 1958. 13p. Dep. NTIS $3.50.

Declassified 12 Jan 1976

Information is presented concerning aircraft propulsion reactor performance requirements, propulsion system characteristics, and reactor materials. (DCC)

16384 (CNLM-875) REACTOR RESEARCH AND DEVELOPMENT PROGRAM THROUGH SEPTEMBER 1959. (Pratt and Whitney Aircraft, Middletown, Conn. (USA)). 1 Jul 1958. 22p. Dep. NTIS $3.50.

Declassified 12 Jan 1976.

Research and development devoted to materials and fuels for high-performance lithium-cooled aircraft reactors is described. (JWR)

16385 (CNLM-1101) FIFTH MONTHLY PROGRESS REPORT. Bearsley, G. E. Jr. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 15 Sep 1958. 3p. Dep. NTIS $3.50.

Declassified 9 Jan 1976.

Design studies for the reactor powerplant for the Princess airplane are described. (DG)

16386 (CNLM-1609) LIQUID CYCLE REACTOR-ADVANCED APPLICATIONS: RESEARCH AND DEVELOPMENT. Quarterly Progress Report. (Pratt and Whitney Aircraft, Middletown, Conn. (USA)). 22 Apr 1959. Contract AT(11-1)-229. 67p. Dep. NTIS $4.50.

Declassified 12 Jan 1976.

Progress in research and development on liquid-cycle aircraft reactors is reported. The program includes advanced applications and low-power testing. (JWR)

16387 (CNLM-2665) TECHNICAL PROGRAM SUMMARY OF THE CONNECTICUT AIRCRAFT NUCLEAR ENGINE LABORATORY. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 27 Jun 1960. 77p. Dep. NTIS $5.00.

Declassified 12 Jan 1976.

Information is presented concerning the low power reactor experiment, advanced reactor engineering and design, reactor physics, heat transfer and propulsion system component development, controls and instrumentation, reactor materials, liquid metal corrosion testing, and propulsion reactor performance evaluation. (DCC)

16388 (CNLM-3317) DEVELOPMENT PLAN FOR NJ-18A POWER PACKAGE FLIGHT TEST PROGRAM, 1963–1967. Greene, R. S. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 24 Jan 1961. Contract AT(11-1)-229. 34p. Dep. NTIS $4.00.

Declassified 12 Jan 1976.

The Pratt & Whitney Aircraft plan for the flight test portion of the engineering and development of an indirect cycle nuclear propulsion system capable of satisfying the requirements of the Convair NX2 airplane is presented. The planning covers the power package scheduling and costing involved in: (1) a flight test-bed program devoted primarily to propulsion system development; and (2) a nuclear powered aircraft development program devoted primarily to the resolution of practical nuclear aircraft operation. These two major programs of flight testing will be conducted in two NX2 aircraft. The program plans, schedules, and cost estimates presented are contingent upon a continuing program from 1960 through 1965 with funds, additional facilities, and new facilities being made available as required. (auth)

16389 (CNLM-3490) [NUCLEAR AIRCRAFT PROPULSION SYSTEM DEVELOPMENT SCHEDULE]. (Pratt and Whitney Aircraft, Middletown, Conn. (USA)). 6 Mar 1961. 28p. Dep. NTIS $4.00.

Declassified 12 Jan 1976.

Specifications for nuclear powered aircraft are presented. Component and materials performance requirements are discussed. Development program schedules are outlined. (DCC)

16390 (CNLM-3642) GENERAL WORK PLAN REACTOR PROGRAM, MAY 1, 1961–SEPTEMBER 30, 1961. (Pratt and Whitney Aircraft, Middletown, Conn. (USA)). 1961. 46p. Dep. NTIS $4.00.

Declassified 12 Jan 1976.

Information on the development of aircraft propulsion reactors is presented concerning the general program, master program schedule, program schedule for May 1961 to December 1961, program cost breakdown, and reactor program material breakdown. (DCC)

16391 (CNLM-3814) STATEMENT OF WORK, OCTOBER 1, 1961–SEPTEMBER 30, 1962. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 31 Aug 1961. Contract AT(30-1)-2789. 9p. Dep. NTIS $3.50.

Declassified 9 Jan 1976.

Engineering design and physics work on a high temperature, liquid metal-cooled, reactor experiment with supporting research and development in the areas of fuel elements, coolants, physics and critical experiments, liquid metal components, controls, and materials are reviewed. Certain structures, hydrodynamic, and components tests which were active under contract AT(11-1)-229 for use in advanced aircraft propulsion systems, and which provide basic technical information useful in broad reactor applications are continued. (auth)

16392 (CNLM-4020) PROPOSED WORK PROGRAM FOR THE SNAP-50 REACTOR AND PRIMARY SYSTEM, FISCAL YEARS 1962 AND 1963. Smith, A. E. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 30 Mar 1962. Contract AT(30-1)-2789. 62p. Dep. NTIS $4.50.

Declassified 3 Dec 1975.

The initial work program proposed by Pratt & Whitney Aircraft in the development of the SNAP-50 reactor and primary system is presented. The objective of the SNAP-50 reactor and primary system development program is the design, fabrication, development, and test operation of a series of reactors and associated equipment leading to a fully qualified and accepted SNAP-50 flight reactor and primary system. The present PWAR-16 reactor experiment program now in progress at CANEL is an important first step in this program. The work proposed to initiate the program to develop the development reactor and primary system consists of work in the following areas: systems analysis to determine design requirements, reactor and primary system preliminary design, experiment in critical areas to confirm the design calculations, preparation of development plans, and initiation of development programs for the reactor fuel, the lithium pump and the potassium boiler. A proposed work statement is presented which lists the tasks of the initial work program, a summary of the schedules and costs, and the subtask descriptions. A list of capital equipment is included in the appendix. (auth)

16393 (CNLM-4099) PRELIMINARY DEVELOPMENT PLAN SNAP-50 REACTOR AND PRIMARY SYSTEM. (Pratt and Whitney Aircraft, Middletown, Conn. (USA)). 15 Jun 1962. Contract AT(30-1)-2789. 51p. Dep. NTIS $4.50.

Declassified 9 Dec 1975.

The Pratt & Whitney Aircraft Preliminary Development Plan for the SNAP-50 reactor and primary systems is presented. The stated objective of this program is the design, fabrication, development, and test operation of a series of reactors and the associated equipment leading to a fully qualified and accepted flight reactor and primary system. The LCRE (previously designated PWAR-16) program now in progress at CANEL is the important first step in this program. The program estimates presented are based on a continuation of the present LCRE program, the availability of SNAP-50-DR-1 funding and new facilities as indicated in this plan, and the continued availability, on a no-charge basis, of the facilities provided or to be provided under facility contract AF 33(600)21099 and by the Atomic Energy Commission under its Use Agreement with the Air Force. (auth)

16394 (CNLM-4100) PRELIMINARY DEVELOPMENT PLAN FOR SNAP-50 POWERPLANT. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 15 Jun 1962. Contract AT(30-1)-2789. 87p. Dep. NTIS $5.00.

Declassified 9 Dec 1975.

A description, and corresponding cost estimate, is presented for facilities associated with the power conversion development program. These facilities represent a nominal upper limit for such needs. This can be explained by the fact that, in estimating these funds, it was assumed that potential power system contractors would not have major liquid metal test facilities available to support the program. A management section is included which presents a plan for making a realistic assessment of the program cost, schedule, and technical requirements and a means of control that assures that adequate resources in the form of manpower, facilities, and material are assigned at the proper times to satisfy these requirements. (auth)

16395 (CNLM-5000) PRELIMINARY SNAP-50 POWERPLANT PROGRAM DOCUMENT FOR FY 1964 AND 1965. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 11 Apr 1963. 23p. Dep. NTIS $3.50.

Declassified 5 Nov 1975.

A description is presented of the proposed development program of the SNAP-50 powerplant for fiscal years 1964 and 1965 with

a schedule and cost estimate. The program is based on the very limited funding available for this program in fiscal year 1964. There is included with this document an addendum which presents several additional work packages and their estimated costs. This work should be included in the fiscal year 1964 program to ensure a reasonable development schedule. (auth)

16396 (CNLM-5033) PROGRAM COST ESTIMATE FOR SNAP-50 POWER CONVERSION COMPONENTS DESIGN AND DEVELOPMENT, FISCAL YEARS 1963–1965. (Pratt and Whitney Aircraft, Middletown, Conn. (USA)). 10 May 1963. Contract AT(30-1)-2789. 16p. Dep. NTIS $3.50.

Declassified 19 Jan 1976.

Cost summaries for subactivities in the SNAP-50 development program are presented. (JWR)

16397 (CNLM-5217) PROGRAM COST ESTIMATE FOR SNAP-50/SPUR. Fiscal Years, 1964–1965. (Pratt and Whitney Aircraft, Middletown, Conn. (USA)). 21 Aug 1963. Contract AT(30-1)-2789. 39p. Dep. NTIS $4.00.

Declassified 3 Nov 1975.

Cost estimates are presented for Fiscal Years 1964 and 1965 for the SNAP-50 powerplant development program being performed by Pratt & Whitney Aircraft-CANEL for the Atomic Energy Commission, in fulfillment of Contract AT(30-1)-2789. The stated objective of the SNAP-50 program is the design, fabrication, and development of an advanced Rankine cycle nuclear-electric space powerplant having a nominal 1 MW(e) output which is suitable to supply power for electrical propulsion, communications, and environment control. Additional powerplant specifications include a design life goal of 10,000 hours, a design goal of 300 to about 1000 kW(e) net unconditioned power to the user, and a design goal system specific weight (unshielded) of 10 to 20 lb/kW(e). To achieve these objectives a compact, lithium-cooled refractory alloy reactor operating at a nominal 2000°F coolant temperature has been selected to supply energy to an advanced potassium-vapor power-conversion cycle. (auth)

16398 (CNLM-5280) PROGRAM COST ESTIMATE FOR SNAP-50/SPUR. Fiscal Years, 1964–1965. (Pratt and Whitney Aircraft, Middletown, Conn. (USA)). 15 Oct 1963. Contract AT(30-1)-2789. 32p. Dep. NTIS $4.00.

Declassified 7 Nov 1975.

Cost estimates are presented for Fiscal Years 1964 and 1965 for the SNAP-50 powerplant development program being performed by Pratt & Whitney Aircraft-CANEL for the Atomic Energy Commission, in fulfillment of Contract AT(30-1)-2789. The stated objective of the SNAP-50 program is the design, fabrication, and development of an advanced Rankine cycle nuclear-electric space powerplant having a nominal 1 MW(e) output which is suitable to supply power for electrical propulsion, communications, and environment control. Additional powerplant specifications include a design life goal of 10,000 hours, a design goal of 300 to about 1000 kW(e) net unconditioned power to the user, and a design goal system specific weight (unshielded) of 10 to 20 lb/kW(e). To achieve these objectives a compact, lithium-cooled refractory alloy reactor operating at a nominal 2000°F coolant temperature has been selected to supply energy to an advanced potassium-vapor power-conversion cycle. (auth)

16399 (CNLM-5553) WEEKLY PROGRESS REPORT, FEBRUARY 17, 1964. Parks, G. U. (Pratt and Whitney Aircraft, Middletown, Conn. (USA)). 21 Feb 1964. Contract AT(30-1)-2789. 7p. Dep. NTIS $3.50.

Declassified 12 Jan 1976.

Progress in the development of components and materials for space power reactors, including SNAP-50, is described. (JWR)

16400 (CNLM-5569) WEEKLY PROGRESS REPORT, FEBRUARY 28, 1964. Parks, G. U. (Pratt and Whitney Aircraft, Middletown, Conn. (USA)). 28 Feb 1964. Contract AT(30-1)-2789. 7p. Dep. NTIS $3.50.

Declassified 12 Jan 1976.

Progress in the development of space power reactors is briefly reported. (JWR)

16401 (CNLM-5629) WEEKLY PROGRESS REPORT, MARCH 27, 1964. Parks, G. U. (Pratt and Whitney Aircraft Middletown, Conn. (USA)). 3 Apr 1964. Contract AT(30-1)-2789. 7p. Dep. NTIS $3.50.

Declassified 12 Jan 1976.

Progress in the development of space power reactors is briefly reported. (JWR)

16402 (CNLM-5732) DESIGN NO. 3 OF SNAP-50/SPUR REACTOR TEST SYSTEMS. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 12 Jun 1963. Contract AT(30-1)-2789. 33p. Dep. NTIS $4.00.

Declassified 8 Dec 1975.

The initial definition of an 8 MW(t), SNAP-50 Reactor Test is presented. The information is based on preliminary studies; and, consequently, the configuration and component sizes have not been firmly established. Where the Nuclear Test Facility design concept will be affected, however, conservative estimates of reactor test component sizes, envelopes, and requirements are presented so that facility design studies can proceed. (auth)

16403 (CNLM-6178) WEIGHT ESTIMATE OF 300 kWe REFRACTORY METAL VERSION OF THE MPRE. Chalfant, A. I. (Pratt and Whitney Aircraft, Middletown, Conn. (USA)). 4 Mar 1965. Contract AT(30-1)-2789. 6p. Dep. NTIS $3.50.

Declassified 9 Jan 1975.

A reactor weight 60% greater and a shield weight 70% greater than previously estimated are reported. This estimate is subject to large errors due to incomplete information on both the 140 kW and 300 kW versions of the MPRE and to lack of information on burnout heat fluxes and other power limiting phenomena. The weight differences are believed to result in part, at least, from optimistic assumptions in the ORNL estimate. (auth)

16404 (CNLM-6258) SNAP-50: P AND WA CANEL PROGRAM INFORMATION. (Pratt and Whitney Aircraft, Middletown, Conn. (USA)). 30 Apr 1965. 25p. Dep NTIS $3.50.

Declassified 15 Jan 1976.

The objectives, task descriptions, costs, and manpower assignments for the SNAP 50/SPUR program are reviewed. (JWR)

16405 (FPS-C-14) PRELIMINARY SPECIFICATION FOR THE JTN-9 AFTERBURNER FUEL CONTROL. (Pratt and Whitney Aircraft, East Hartford, Conn. (USA)). 29 Apr 1966. 7p. Dep. NTIS $3.50.

Declassified 9 Jan 1976.

Design requirements are presented for a JTN-9 engine afterburner fuel control. The afterburner fuel control is a hydromechanical type, scheduling fuel flow as a function of absolute compressor discharge pressure and lever angle. (auth)

16406 (PWAC-168) NUCLEAR ENGINEERING PROGRAM. Topical Report No. 2. (Pratt and Whitney Aircraft, East Hartford, Conn. (USA)). 15 Mar 1957. Contract AT(11-1)-229. 15p. Dep. NTIS $3.50.

Declassified 3 Nov 1975.

Preliminary estimates are presented of the size and performance of four nuclear power plants proposed for an airplane which can cruise at supersonic speeds without any chemical fuel thrust augmentation. The reactor is an advanced solid-fuel-type cooled by lithium and the engines are modified Pratt & Whitney Aircraft J-91 turbojets. The engines and reactor are matched at Mach 2.0 and 45,000 feet altitude and performance data for maximum thrust is presented for off-design operation. This data is based on an assumed power plant and will be revised following the completion of a component optimization which is presently under way. Part-load performance is not presented. (auth)

Reactor Safety and Environmental Aspects

Refer also to abstracts 14828, 14830, 14831, and 15098.

16407 (AAEC/IP-7) NUCLEAR POWER PLANT SAFETY: THE RISK OF ACCIDENTS. Higson, D.; Crancher, D. W. (Australian Atomic Energy Commission, Coogee). Aug 1975. 29p. Dep. NTIS (US Sales Only) $4.50.

The public risks that could be involved in potential accidents in commercial nuclear power plants of the type now in general use throughout the world are reviewed. (auth)

16408 (AI-ERDA-13161) NUCLEAR SAFETY CHARACTERIZATION OF SODIUM FIRES AND FAST REACTOR FISSION PRODUCTS. Quarterly Technical Progress Report, July–September 1975. (Atomics International Div., Canoga Park, Calif. (USA)). 15 Nov 1975. Contract AT(04-3)-824. 24p. Dep. NTIS $4.00.

Progress is reported in the areas of sodium jet dispersal tests, SOMIX code development, aerosol leakage, fuel and fission product release from burning sodium, and properties of high temperature fuel mixture. (DG)

16409 (ANCR-1234) EXPERIMENT DATA REPORT FOR SEMISCALE MOD-1 TEST S-02-4 (BLOWDOWN HEAT TRANSFER TEST). Crapo, H. S.; Jensen, M. F.; Sacket, K. E. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). Nov 1975. Contract E(10-1)-1375. 94p. Dep. NTIS $5.45.

Recorded test data are presented for Test S-02-4 of the Semiscale Mod-1 blowdown heat transfer test series. Test S-02-4 is one of several Semiscale Mod-1 experiments conducted to investigate the thermal and hydraulic phenomena accompanying a hypothesized loss-of-coolant accident (LOCA) in a water-cooled nuclear reactor system and to provide data for the assessment of the Loss-of-Fluid Test (LOFT) design basis. Test S-02-4 was conducted from an initial cold leg fluid temperature of 544°F and an initial pressure of 2,263 psia. A simulated double-ended offset shear cold leg break was used to investigate the system response to a depressurization transient with full design core power (1.6 MW). An electrically heated core was used in the pressure vessel to simulate the effects of a nuclear core. System flow was set to achieve the full design core temperature differential of 66°F. The flow resistance of the intact loop was based on core area scaling. During system depressurization, core power was reduced from the initial level of 1.6 MW in such a manner as to simulate the surface heat flux response of the LOFT nuclear fuel rods until such time that departure from nucleate boiling (DNB) occurs. Blowdown to the pressure suppression system was accomplished without simulated emergency core cooling injection or pressure suppression system coolant spray. The uninterpreted data from Test S-02-4 are presented for future data analysis and test results reporting activities. The data, presented in the form of graphs in engineering units, have been analyzed only to the extent necessary to assure that they are reasonable and consistent. (auth)

16410 (ANL-75-67) PHYSICS OF REACTOR SAFETY. Quarterly Report, April–June 1975. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-Eng-38. 16p. Dep. NTIS $4.00.

Reports on reactor safety research and technical coordination of the RSR safety analysis program by members of the Reactor Safety Appraisals Group, Monte Carlo analysis of safety-related critical assembly experiments by members of the Theoretical Fast Reactor Physics Group, and planning of DEMO safety-related critical experiments by members of the Zero Power Reactor (ZPR) Planning and Experiments Group are described. (auth)

16411 (ANL-Trans-1030) DEVELOPMENT OF THE RADIOLOGICAL SAFETY STUDIES FOR FRENCH REACTORS AND THEIR SITES. Candes, P. Jul 1975. Translation of CEA-CONF-1877. 25p. Dep. NTIS $3.50.

From international conference on chemical sciences; Paris, France (20 Apr 1971).

See CONF-710444-2.

The study of the safety of large power plants leads to the consideration of all situations, normal or accidental, in which the radioactivity produced in the core is transported by installations in the plant to points where its presence is not desired and to environmental sites where it can reach the population. In order to evaluate these transports, theoretical studies were done to know the transportation to different points in the installation as a function of characteristics or supposed faults of the system. These studies permit evaluation of the radiation levels attained in different parts of the installation and suggest appropriate safety measures. Particular attention is attached to the evaluation of the consequences of an accident and the technical precautionary devices to counter them. The study of the confinement of the installation responds particularly to this goal. (auth)

16412 (BNL-50455) DEVELOPMENT OF A COMPUTER CODE FOR THERMAL HYDRAULICS OF REACTORS (THOR). Second Quarterly Progress Report, January–March 31, 1975. Wulff, W. (Brookhaven National Lab., Upton, N. Y. (USA)). Apr 1975. Contract AT(30-1)-16. 73p. Dep. NTIS $4.75.

The purpose of the advanced code development work is to construct a computer code for the prediction of thermohydraulic transients in water-cooled nuclear reactor systems. The fundamental formulation of fluid dynamics is to be based on the one-dimensional drift flux model for non-homogeneous, non-equilibrium flows of two-phase mixtures. Particular emphasis is placed on component modeling, automatic prediction of initial steady state conditions, inclusion of one-dimensional transient neutron kinetics, freedom in the selection of computed spatial detail, development of reliable constitutive descriptions, and modular code structure. (auth)

16413 (COO-2294-2) SOME POSSIBLE EFFECTS OF HOT WALLS ON FLOW IN PWR DOWNCOMERS DURING THE ECCS INJECTION PHASE OF A LOSS OF COOLANT ACCIDENT, FOLLOWING THE END OF BLOWDOWN. Wallis, G. B.; Ludwig, D. L.; Allen, J. E. (Dartmouth Coll., Hanover, N. H. (USA). Thayer School of Engineering). Jun 1975. Contract AT(11-1)-2294. vp. NRC.

The phenomena which may limit the flow rate of a boiling liquid penetrating into a restricted space with walls initially above the saturation temperature are discussed and several "limiting" or "idealized" analyses are presented. Comparison is made with experimental results obtained in small scale apparatus duplicating some of the essential features of the downcomer region of a pressurized water reactor. The possible application of these results for predicting the behavior of large scale tests is discussed. (auth)

16414 (CONF-760202-6) APPLICATION OF THE ALAP CONCEPT TO OCCUPATIONAL EXPOSURE AT OPERATING LIGHT WATER REACTORS. Dickson, H. W.; Cottrell, W. D.; Jacobs, D. G. (Oak Ridge National Lab., Tenn. (USA)). 1975. 8p. Dep. NTIS $4.50.

From 9th topical symposium on operational health physics; Denver, Colorado, USA (9 Feb 1976).

The application of the as-low-as-practicable (ALAP) concept to radiation exposure of workers at light-water reactors (LWR's) has recently received increased attention. The purpose of the project described is to investigate the means by which occupational exposure at operating LWR's can be reduced to the lowest practicable levels. Nine LWR stations, including 16 operating reactors, were studied in Phase I of the project to identify significant sources of exposure and to determine the magnitude of the exposures. A complete site review consists of compiling information from safety analysis reports, plant technical specifications, and radiation exposure records coupled with an on-site visit for discussions with plant personnel, observation of procedures, and measurement of radiation levels. In Phase II, specific problem areas are being studied in-depth with regard to corrective measures to reduce exposure. Information has been collected on exposure from valve maintenance and repair. Corrective measures will be evaluated with respect to ease of application and cost effectiveness. The results presented will serve as technical backup for the preparation of regulatory guides. (auth)

16415 (CREARE-TN-217) ECC DELIVERY STUDY: EXPERIMENTAL RESULTS AND DISCUSSION. Crowley, C. J.; Block, J. A. (Creare, Inc., Hanover, N. H. (USA)). Oct 1975. 130p. Dep. NTIS $6.00.

The results of a series of separate effects and combined effects tests in a 1/15-scale planar model of a Pressurized Water Reactor (PWR) downcomer region at or near atmospheric pressure are presented. These tests are part of a continuing effort to develop analytical tools and predictive techniques to permit the calculation of lower plenum filling rates, as a function of time, during a postulated Loss-of-Coolant Accident (LOCA) in PWRs. The effects of reversed core steam flow, cold leg steam flow, and superheated walls on the timing and rate of delivery to the lower plenum of simulated Emergency Core Coolant (ECC) were investigated separately and in various combinations along with variations in the downcomer gap spacing, ECC water temperature, ECC water flow rate, and other parameters. The tests with reversed core steam flow and neutral walls showed that the downcomer gap size does not correlate the results, and also that increased water flow rate or water subcooling resulted in delivery to the lower plenum at higher steam flow rates (and hence earlier in the postulated LOCA transient). Reversed core steam flow and superheated walls combined produced an effect on water delivery which was greater than either effect acting separately. In addition, plenum filling was found not to be an "off-on" process and thus the filling rate as a function of time is the important result from downcomer penetration studies. (auth)

16416 (ETR-1002) DESIGN CONSIDERATIONS FOR THE PROTECTION FROM THE EFFECTS OF PIPE RUPTURE. (Ebasco Services, Inc., New York (USA)). Nov 1975. 119p. Ebasco Services, Inc., New York, NY.

The methods which are employed by Ebasco Services, Inc. to satisfy the requirement of 10 CFR 50, Appendix A, General Design Criterion (GDC) 4 are discussed. This criterion provides the design basis for protection against the dynamic effects of postulated piping failures (ruptures and cracks) in Nuclear Power Plants. The criteria for postulating pipe failure locations, determining the dynamic effects associated with the postulated failure and designing the plant to satisfactorily withstand postulated pipe failures have been the subject of a great deal of recent work by the nuclear power industry and the Nuclear Regulatory Commission (NRC). This topical report is largely based upon that work as well as upon Ebasco's independent development of analytical tools to aid in the plant design process. (auth)

16417 (EURFNR-1293) ANALYSIS OF TRANSIENT OVERPOWER ACCIDENTS FOR THE SNR-300 MARK-1 AND MARK-1A CORES. Evrard, G.; Froehlich, R.; Renard, A.; Schmuck, P. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik). Sep 1975. 81p. (KFK-2115). Dep. NTIS (US Sales Only) $5.00.

Work performed under United States–Euratom Fast Reactor Exchange Program.

Two hypothetical whole core disruptive accidents are considered for the licensing procedures of the SNR-300-reactor: flow coastdown due to primary pump failure with simultaneous failure of the primary and secondary shutdown systems; and an unlimited reactivity insertion rate (e.g. 5 $/sec) with simultaneous failure of the primary and secondary shutdown systems. The accidental sequence consists of two phases: the predisassembly- and the disassembly-phase, which are calculated by the two coupled computer codes CARMEN2 and KADIS. The two cores Mark 1 and Mark 1A are described and the most important differences of both cores are explained. The calculational methods are briefly discussed and some remarks about details of the accident analysis are made. The results of the predisassembly- and disassembly-calculations are presented. (auth)

16418 (GA-A-13617(Vol. 2)) HTGR ACCIDENT INITIATION AND PROGRESSION ANALYSIS STATUS REPORT. Volume II. AIPA Risk Assessment Methodology. Fleming, K. N.; Raabe, P. H.; Hannaman, G. W.; Houghton, W. J.; Pfremmer, R. D.; Dombek, F. S. (General Atomic Co., San Diego, Calif. (USA)). Oct 1975. Contract E(04-3)-167. vp. Dep. NTIS $7.60.

A comprehensive summary is presented of the methods and techniques used in risk analyses. Included are discussions of initiating event selection, event tree construction, probability evaluation, consequence evaluation, and presentation of results. (DG)

16419 (GEAP-14038-3) ADVANCED SAFETY ANALYSIS, Third Quarterly Report, March–May 1975. (General Electric Co., Sunnyvale, Calif. (USA). Fast Breeder Reactor Dept.). Jun 1975. Contract AT(04-3)-893. 102p. AT.

LMFBR safety-related studies are described concerning engineering analysis of post-accident heat removal, inherently safe core design, fuel pin failure mechanisms, and LMFBR shutdown system reliability goals. (DCC)

16420 (INIS-mf-1779) ROUTINE MANUAL FOR NUCLEAR POWER PLANTS INSPECTION. Recommendations for Regular Proofs of the Safety Systems. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). 1974. 15p. (In Spanish). INIS.

16421 (INIS-mf-1780) SAFETY STANDARDS FOR NUCLEAR POWER PLANTS. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). Aug 1974. 22p. (In Spanish). INIS.

The basic principles on which the various nuclear nations base their concept of reactor safety are reviewed. Safety criteria applied to the design and construction of a thermal power reactor are discussed. The topics considered are the reactor core, primary coolant system and the pressure vessel, instrumentation, control and operating devices, and devices to limit the release of radioactivity in case of an accident. (JSR)

16422 (IRS-T-27) TECHNICAL MEETING ON PROTECTION OF NUCLEAR POWER PLANTS AGAINST EXTERNAL INFLUENCES, COLOGNE, GERMANY, OCTOBER 30–31, 1974. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F. R. Germany)). Apr 1975. 172p. (In German). (CONF-741075–). Institut fuer Reaktorsicherheit, Koeln, Germany.

Five papers are presented which deal with the protection of nuclear power plants from external influences. The above papers were separately abstracted and indexed for NSA and appear as abstract numbers 31:21763, 31:21764, 31:21765, 31:21824, and 31:21825. An additional paper on the fusion reactor by R. Wienecke is separately abstracted and indexed in this issue of NSA. (DG)

For an abstract of an individual paper see: 14539.

16423 (KSC-1037-1) RELIABILITY ANALYSIS OF AN HTGR SCRAM SYSTEM INCLUDING HUMAN INTERFACES. Final Report. Becar, N. J.; Curtis, G. B.; Wood, D. E. (Kaman Sciences Corp., Colorado Springs, Colo. (USA)). Mar 1975. Contract AT(04-3)-1037. 386p. Dep. NTIS $10.60.

The SCRAM Protective System for Fort St. Vrain HTGR power plant has been reviewed in depth using the "GO" reliability analysis technique developed by Kaman Sciences Corporation. A GO logic model of the SCRAM Protective System was created by referencing an intermediate set of logic schematics drawn from numerous detailed system drawings and procedures. Computer analysis of the model provided success probabilities for the various events. Time lines were constructed from the operational and surveillance procedures to define significant points of human interface. The results of the GO analysis indicate that the probability of SCRAM failure is small. Signals from individual SCRAM parameters were evaluated to determine those parameters which might be most effectively improved, if desired, in future reactors. A sensitivity analysis was performed to define the major contributors to system unreliability. Accident scenarios, as submitted by RRD, AEC (ERDA), were evaluated to show the improvement in SCRAM reliability resulting from functional diversity, and to rank the probabilities of successful SCRAM when initiated by the postulated accidents. In the most sensitive areas, results are presented parametrically for ease of extrapolation to newer HTGR designs. (auth)

16424 (LA-6104-MS) NUMERICAL CALCULATION OF FLASHING FROM LONG PIPES USING A TWO-FIELD MODEL. Rivard, W. C.; Torrey, M. D. (Los Alamos Scientific Lab., N. Mex. (USA)). Nov 1975. Contract W-7405-Eng-36. 13p. Dep. NTIS $4.50.

A two-field model for two-phase flows, in which the vapor and liquid phases have different densities, velocities, and temperatures, has been used to calculate the flashing of water from long pipes. The IMF (Implicit Multifield) technique is used to numerically solve the transient equations that govern the dynamics of each phase. The flow physics is described with finite rate phase transitions, interfacial friction, heat transfer, pipe wall friction, and appropriate state equations. The results of the calculations are compared with measured histories of pressure, temperature, and void fraction. A parameter study indicates the relative sensitivity of the results to the various physical models that are used. (auth)

16425 (LA-UR-75-2085) POSSIBLE APPLICATION OF NONREDUNDANT PINHOLE ARRAYS TO FUEL PIN IMAGING. Berzins, G. J.; Han, K. S. (Los Alamos Scientific Lab., N. Mex. (USA)). Nov 1975. Contract W-7405-Eng-36. 15p. (CONF-751141-2). Dep. NTIS $4.50.

From meeting on fuel and clad motion diagnostics in LMFBR safety test facilities; Albuquerque, New Mexico, USA (11 Nov 1975).

LMFBR Safety Test Facility imaging experiments rely on emission of radiation by the fuel pins and thus appear to strongly complement radiographic techniques in that they are most employable during peak excursion—a time of least favorable radiographic signal-to-noise ratio. Radiography, on the other hand, can provide information long before or after the excursion—times of below threshold signal for direct imaging techniques. An underlying premise of any imaging experiment is that, in addition to sufficient brightness, sufficient contrast exists in the scene. A further restriction is imposed by intervening materials, such as the wall of a containment vessel, that not only absorb but also scatter the radiation. These questions are approached by examining the properties of potential recording instrumentation, of pinhole apertures, and of the necessary radiation sources. (auth)

16426 (LA-UR-75-2212) SIMULATION OF LMFBR TEST FACILITY CONDITIONS WITH LASL CRITICAL ASSEMBLIES. Orndoff, J. (Los Alamos Scientific Lab., N. Mex. (USA)). Nov 1975. Contract W-7405-Eng-36. 12p. (CONF-751141-3). Dep. NTIS $4.50.

From meeting on fuel and clad motion diagnostics in LMFBR safety test facilities; Albuquerque, New Mexico, USA (11 Nov 1975).

Two critical assemblies at LASL are being adapted to simulate LMFBR Safety Test Facility (STF) conditions: (1) the PARKA critical assembly is being modified to serve as a driver for fuel pin arrays at the center for scaled-down simulation of STF; and (2) a moderator geometry adjacent to the Godiva IV prompt burst assembly provides the capability of driving a few fuel pins to instantaneous power levels higher than those expected in STF transients. These simulation facilities are discussed. (auth)

16427 (NED-IR-10) SECURITY LIMITATIONS IN REACTOR SAFETY AND THE CLASSIFICATIONS OF THE ABNORMAL OPERATING CONDITIONS WHICH CAN CAUSE THE REACTOR TO BE SHUTDOWN. Alat, A. (Turkiye Elektrik Kumuru Nukleer Enerji Dairesi, Ankara). Nov 1974. 46p. (In Turkish). INIS.

The security limitations of the (PWR) pressurized water reactors are described and the abnormal operating conditions which can cause the reactors to be shutdown are classified. By defining the security criteria the deviations from the normal operating conditions varying in different groups to the probability are explained and the abnormalities in these groups are analyzed. (INIS)

16428 (ORNL-5110) FINAL REPORT ON PCRV THERMAL CYLINDER AXIAL TENDON FAILURES. Canonico, D. A.; Griess, J. C.; Robinson, G. C. (Oak Ridge National Lab., Tenn.

(USA)). Jan 1976. Contract W-7405-eng-26. 18p. Dep. NTIS $5.00.

The post-test examination of the failed tendons from the PCRV thermal cylinder experiment has been concluded. Failures in the wires are attributed to stress-corrosion cracking. The cause of tendon failures has not been unequivocably established, but they may have been due to nitrates in the duct. The wires employed in the manufacture of the tendons will crack in less than 72 hr in a 0.2 M solution of ammonium nitrate at 70°C. The quality of the wires is poor, and surface cracks were detected. These could have acted as concentrating sites for both stress and the deleterious contaminants. It is believed that the factors that led to the failures in the thermal cylinder experiment were unique. An improper formulation of the epoxy resin did not provide the tendon anchor plate seal that was desired; indeed, the improper formulation is responsible for the high level of nitrogen in the ducts of the failed tendons. (auth)

16429 (ORNL-TM-5238) MONTHLY PROGRESS REPORT FOR DECEMBER 1975 FOR THE HTGR SAFETY STUDIES FOR THE DIVISION OF TECHNICAL REVIEW U. S. NUCLEAR REGULATORY COMMISSION. Sanders, J. P. (Oak Ridge National Lab., Tenn. (USA)). Jan 1976. Contract W-7405-eng-26. 12p. Dep. NTIS $4.50.

Brief highlights are presented for the following activities: HEXERI code development; FLOOIS code development; analysis of thermal barrier cover plates; and determination of physical property values for helium-air mixtures. (JWR)

16430 (SAND-75-0632) LIGHT WATER REACTOR SAFETY RESEARCH PROGRAM. Quarterly Report, July–September 1975. Butcher, B. M. (ed.). (Sandia Labs., Albuquerque, N. Mex. (USA)). Dec 1975. Contract AT(29-1)-789. 71p. Dep. NTIS $4.50.

Research progress is reported for the molten core--concrete interactions study and for studies on steam explosion phenomena. (JWR)

16431 (WCAP-8623) WESTINGHOUSE ECCS EVALUATION MODEL, OCTOBER 1975 VERSION. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Nov 1975. vp. Westinghouse Electric Corp., Pittsburgh, PA.

A description is given of four changes made to the Westinghouse ECCS evaluation model. The changes, which are based on recent test data, include a new reflood heat transfer correlation, a revised flow blockage model, a new equation to predict the hot wall delay time, and a modified rod burst curve. (auth)

16432 (XN-75-41(Suppl.7)) EXXON NUCLEAR COMPANY WREM-BASED GENERIC PWR ECCS EVALUATION MODEL. Supplement 7. Supplementary Information. (Exxon Nuclear Co., Richland, Wash. (USA)). 9 Nov 1975. 51p. Exxon Nuclear Co., Richland, WA.

Supplementary information on the Exxon Nuclear Company WREM-based generic PWR ECCS evaluation model is presented. Included are sections on large break model description, small break model description, supplementary coding information, justification of use of open channel critical flow for calculation of cold leg spillage during hot wall delay, and calculation of core inlet subcooling for reflood analysis. (auth)

16433 (XN-75-64) EXXON NUCLEAR COMPANY WREM-BASED GENERIC PWR ECCS EVALUATION MODEL PALISADES TYPE COMBUSTION ENGINEERING PLANT LARGE BREAK EXAMPLE PROBLEM. Jensen, S. E.; Kayser, W. V.; Worley, L. C.; Yates, J.; Pugh, R. A. (Exxon Nuclear Co., Richland, Wash. (USA)). 7 Dec 1975. 51p. Exxon Nuclear Co., Richland, WA.

The WREM/ENC calculational procedure is demonstrated using a Combustion Engineering Plant of the Palisades type. The calculational procedures used are in accordance with the ENC PWR evaluation model. The loss-of-coolant accident investigated was a split configuration with a break area equal to twice the pipe cross-sectional area. The break was assumed to occur in one cold leg or pump discharge pipe. The investigation involved calculations using the following primary WREM/ENC codes: RELAP-EM for blowdown and hot channel analysis, TOODEE2 for hot channel during refill and reflood, and RELAP4-EM FLOOD for core reflood analysis. Descriptions are included of all portions of the loss-of-coolant analysis. Principal results of these analyses are presented, including peak clad temperatures and metal/water reaction percentages. Also included are summaries of the transient time sequences for major events. All salient results from the example analysis are presented in graphical form. (auth)

16434 NUCLEAR POWER PRODUCTION. New York; United Nations (1975). 98p.

Radiation doses to the public resulting from fuel cycle operations are estimated. Effluents are identified and resulting doses are estimated for mining and milling operations, fuel fabrication, reactor operation, fuel reprocessing, and transportation. (DG)

16435 APPROXIMATE METHOD OF CALCULATING THE TEMPERATURE OF FUEL ELEMENTS UNDER CONDITIONS OF STEAM PENETRATION OF A REACTOR CORE. Rassokhin, N. G.; Kuzevanov, V. S. (Moscow Power Inst.). Therm. Eng. (USSR) (Engl. Transl.); 21: No. 12, 76-82(Dec 1974).

Translated from Teploenergetika; 21: No. 12, 52-57(Dec 1974).

An approximate analytical method of solving a system of differential equations is presented for equations for non-steady heat transfer for fuel elements with internal sources of heat and external heat removal in a one dimensional approximation and equations for the heat balance for the coolant in a transient process. The disturbing influence investigated which causes undue heating up of the fuel elements is an abrupt alteration in the thermophysical characteristics of the single-phase coolant flowing through the reactor core and an alteration in the output of the fuel elements. To make the analytical method and the final results of the calculations more specific, the particular example of the disturbing influence noted above – change of the coolant (water → steam) in the core during the emergency and simultaneous drop of the emergency control rods is assumed. A water-moderated water-cooled research reactor loss-of-coolant condition is studied. (auth)

16436 EMERGENCY EVACUATION PLANS FOR NUCLEAR PLANTS. Jacobson, N. Rudolph, WI; LAND, Inc. (1975). 12p. $1.00.

A critical commentary is presented on nuclear power plant emergency evacuation plans and procedures. The author alleges a deliberate withholding of information by officials in order to avoid generating public concern over power plant hazards. (DG)

16437 EXPERIMENTAL AND THEORETICAL STUDIES OF CRITICALITY SAFETY BY INGRESS OF WATER IN SYSTEMS WITH PEBBLE-BED HIGH-TEMPERATURE GAS-COOLED REACTOR FUEL. Drueke, V.; Filges, S.; Kirch, N.; Neef, R. D. (Kernforschungsanlage, Juelich, Ger.). Nucl. Sci. Eng.; 57: No. 4, 328-332(Aug 1975).

Experiments in a subcritical assembly with pebble-bed high-temperature gas-cooled reactor fuel and hydrogen ranging between 0 and 14.4 vol percent were carried out to study the effects of water ingress on reactivity and to test the accuracy of diffusion-code calculations for small subcritical systems. Special emphasis is given to an adequate description of the influence of the water ingress on the diffusion properties of the pebble-bed system. The agreement between experimental and theoretical results is in all cases better than +-0.01 in k/sub eff/. (auth)

16438 INFLUENCE OF MATERIALS PROPERTIES ON STRESS AND DEFORMATION STATES OF A PRESTRESSED CONCRETE VESSEL. Hansson, V.; Stangenberg, F. (Bochum Univ. (F. R. Germany)). pp 68-86 of Prestressed-Concrete Reactor Pressure Vessel. Berlin, F. R. Germany; Ernst (1974). (In German)

39 figs.; 10 refs.

The influence of changes in some material parameters on relevant operational states is studied for a vessel with a concrete liner temperature of 70°C. The results are given for the following material properties: thermal conductivity, thermal expansion coefficient, Young's modulus, temperature dependency of the creep, steel tendon relaxation. The influence of changes in the initial strain due to deformation of the vessel also gets a mention. As the behavior at 70°C does not deviate significantly from the behavior described in the extensive studies on a vessel of 50°C, the calculations are essentially confined to two final operational states which illustrate the influence of the material parameters on the strains and deformations which are of interest for the layout of the vessel. (DE)

16439 PARAMETER CALCULATIONS ON A REFERENCE VESSEL. Szimmat, J.; Willam, K. J. (Stuttgart Univ. (TH) (F. R. Germany)). pp 55-66 of Prestressed-Concrete Reactor Pressure Vessel. Berlin, F. R. Germany; Ernst (1974). (In German)

29 figs.; 3 refs.

This report summarizes some results of a parameter investigation on a reference vessel, which was proposed during a round table discussion of members of the "Spannbeton-Reaktordruckbehaelter" research project. The primary goal was to study variations of the constitutive parameters and two creep analysis methods on the long term behavior of a prestressed concrete nuclear containment. The configuration of the reference vessel resembles the THTR 300 MW, Schmehausen. In particular, the

temperature sensitivity of the modulus of elasticity, the coefficient of thermal expansion and the creep function are examined with regard to their effect on the structural response. In addition, results of different creep calculations are compared using the effective modulus method and the rate of creep method. (DE)

16440 BURSTING PRESSURE OF CYLINDRICAL PRESTRESSED-CONCRETE REACTOR PRESSURE VESSELS. Herzog, M. Bautechnik; 52: No. 3, 73-76(Mar 1975). (In German)
9 figs.; 9 refs.

From the re-evaluation of an American test series using 16 model vessels a very simple and clear method of precalculation of the bursting pressures of cylindrical prestressed-concrete reactor pressure vessels could be derived, the exactness of which is fully sufficient for design purposes. (DE)

16441 REACTOR PROTECTION SYSTEM. Stute, H. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F. R. Germany)). Arch. Tech. Mess. Messtech. Prax.; 472: 73-81(May 1975). (In German)
2 tabs.; 20 refs.

The reactor protection system which in early reactor engineering had been regarded as a release system for measures to interrupt the chain reaction has a far more important function in modern nuclear power stations. The inevitable heightening of our understanding of the processes of failure analysis in ever larger structural components has brought about the realization that a great number of active measures must be provided for with just as much reliability as the rapid shutdown itself if the probability of an unduly high radioactive load of the environment in cases of accident is to be kept low. (DE)

16442 PROCESS DYNAMICS, ADVANTAGE AND DIFFICULTIES OF INVESTIGATIONS. Oude-Hengel, H. H. (Technischer Ueberwachungs-Verein Rheinland e.V., Koeln (F. R. Germany). Abt. Grosskraftwerke); Geigle, F. W.; Drucks, G. (Technischer Ueberwachungs-Verein Rheinland e.V., Koeln (F. R. Germany). Gruppe Prozessdynamik). pp 163-178 of Power Plant Engineering. Reliability Enhancement and Operation Optimization. Koeln, F. R. Germany; TUeV Rheinland (1974). (In German)

From symposium "Power plant engineering-Reliability enhancement and operation optimization"; Bad Neuenahr, F. R. Germany (7 Oct 1974). 7 figs.; 3 tabs.; 12 refs.

Process models are designed to inform about stressability of power plants. Some of the most important models are assessed. Mathematical results concerning a turbine trip incident are made clear. Finally some of the problems are dealt with which occur while investigating process dynamics. (DE)

16443 THERMAL STRESSES IN THE NON-STATIONARY OPERATION OF POWER PLANTS. Pich, R. (Energie- und Verfahrenstechnik G.m.b.H. (EVT), Stuttgart (F. R. Germany)). pp 179-199 of Power Plant Engineering. Reliability Enhancement and Operation Optimization. Koeln, F. R. Germany; TUeV Rheinland (1974). (In German)

From symposium "Power plant engineering-Reliability enhancement and operation optimization"; Bad Neuenahr, F. R. Germany (7 Oct 1974). 18 figs.; 29 refs.

This paper deals in a general way with basic theoretical connections concerning non-stationary thermal stress, decisive difference in temperature, the transient and quasi-stationary state, the superposition of mechanical stresses, permissible stress on material, the use of computer programs, and thoughts on process handling. (DE)

16444 PREDICATION OF RELIABILITY ANALYSES. Heuser, F. W. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F. R. Germany). Gruppe Zuverlaessigkeit); Ullrich, W. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F. R. Germany). Abt. Auslegung). pp 47-65 of Power Plant Engineering. Reliability Enhancement and Operation Optimization. Koeln, F. R. Germany; TUeV Rheinland (1974). (In German)

From symposium "Power plant engineering-Reliability enhancement and operation optimization"; Bad Neuenahr, F. R. Germany (7 Oct 1974). 12 figs.; 28 refs.

After an introduction into basic conceptions of reliability analyses (sizing up of plant availability and safety), the methods of system analysis as well as methods for mathematical evaluations, especially principal features of simulation processes, are discussed. Aim and predication of reliability analyses are illustrated by means of practical examples taken from nuclear technology. In order to ascertain reliability data from plant operation first evaluations from the RWE-Bayernwerk reactor are disclosed. (DE)

16445 CRITICAL COMPONENTS IN THE WATER PART OF POWER PLANT UNITS. Uebing, D. (Technischer Ueberwachungs-Verein Rheinland e.V., Koeln (F. R. Germany); Stuttgart Univ. (TH) (F. R. Germany). Fachbereich Energietechnik); Hermann, H. (Technischer Ueberwachungs-Verein Rheinland e.V., Koeln (F. R. Germany). Abt. Grosskraftwerke). pp 81-98 of Power Plant Engineering. Reliability Enhancement and Operation Optimization. Koeln, F. R. Germany; TUeV Rheinland (1974). (In German)

From symposium "Power plant engineering-Reliability enhancement and operation optimization"; Bad Neuenahr, F. R. Germany (7 Oct 1974). 13 figs.; 2 tabs.; 32 refs.

After giving a survey of how damages and failures are divided among components in the water part, the main influences which promote damages are highlighted. Procedures are proposed which are suitable to increase safety and to prevent damages. (DE)

16446 ENVIRONMENT AND NUCLEAR POWER. Wright, J. H. Pittsburgh; Westinghouse Electric Corporation [nd]. 43p.

A compilation is presented of a series of five articles which originally appeared in the Atomic Power Digest, a quarterly publication of Westinghouse Nuclear Energy Systems. The articles deal with: radiation effects on man and his environment; impact on the environment of single and multiple power plants; effects and management of thermal discharges; the role of nuclear power in building a better environment; and relative environmental effects of different types of power generation. (auth)

16447 NUCLEAR POWER PLANTS IN MARYLAND. Eaton, W. W. Annapolis; Governor's Task Force on Nuclear Power Plants (1969). 175p.

The Governor's Task Force was asked to study the following question: Do the special characteristics of nuclear power plants constitute a sufficient threat to the health, safety, or economy of Maryland or its citizens to justify further action on the part of the State. The conclusions and recommendations of the Task Force are presented. (MPG)

16448 NUCLEAR POWER PLANT SAFETY. Administrator's Guide No. 2. Atlanta; Southern Interstate Nuclear Board (1972). 96p.

A report is presented whose purpose is to present, in layman's terms, objective information on nuclear reactors, their safety, and their environmental impact. The report includes a monograph entitled Power Reactor Shielding for the Layman. This is followed by chapters on the following subjects: reactor operating principles, radiation, reactor types, current status and forecast of nuclear power plants, nuclear power plant components, nuclear power plant personnel requirements, radioactive material control during routine operation, thermal effluents, transportation, nuclear fuel reprocessing, radioactive waste management, licensing and regulation of nuclear power plants, accident prevention, accident containment, and safety research. (MPG)

16449 FOSSIL-FUELLED POWER PLANTS ARE DANGEROUS, TOO. OETV (Oeff. Dienste. Transp. Verkehr) Mag.; No. 7, 12-13(Jul 1975). (In German)

An interview with Federal Minister Matthoefer: none of the technologies applied is absolutely harmless, but nuclear energy is far enough under control to ensure a justifiable relation between its risks and advantages. (DE)

16450 COMPARATIVE INVESTIGATION OF DIFFERENT METHODS FOR EVALUATING THE RELIABILITY OF COMPLEX SYSTEMS. Kamarinopoulos, L.; Richter, G. (Technische Univ. Berlin (F. R. Germany). Inst. fuer Kerntechnik). Atomkernenergie; 26: No. 2, 107-113(1975). (In German)
3 figs.; 8 refs.

The present investigation reveals that the numerical evaluation of exact theoretical models to determine the occurrence probability of the first system failure of cut sets needs extensive computer-time. Hence, approximate methods have to be applied which differ in quality. Simple methods cannot adequately deal with cut sets involving components which require a long time for repair or cannot be repaired. Thus, the present method which implies use of a renewal density function and may be written in closed analytical form seems to be the only satisfactory alternative for evaluating a large number of cut sets with arbitrary properties of the components involved. Application of the methods is demonstrated by numerical examples. (DE)

16451 PROCEEDINGS OF U.S. NATIONAL CONFERENCE ON EARTHQUAKE ENGINEERING 1975, ANN ARBOR, MICHIGAN, JUNE 18-20, 1975. Oakland, CA; Earthquake Engineering Research Institute (1975). 672p. (CONF-7506107-). $20.00.
Separate abstracts were prepared for nine papers. (JWR)

For abstracts of individual papers see: 14809, 16452-16458, and 16538.

16452 EVALUATION OF EARTHQUAKE GROUND-MOTION CHARACTERISTICS AT NUCLEAR PLANT SITES. Werner, S. D. (Agbabian Associates, El Segundo, CA). pp 462-473 of Proceedings of U. S. National Conference on Earthquake Engineering 1975. Oakland, CA; Earthquake Engineering Research Institute (1975).

From U. S. national conference on earthquake engineering; Ann Arbor, Michigan, USA (18 Jun 1975). See CONF-7506107-.

Criteria from Appendix A, 10 CFR, Part 100, for the specification of vibratory ground motions at nuclear plant sites are examined. The practice of considering local soil effects along with available measured records to produce seismic motion specifications consistent with the requirements is discussed. An assessment of the current technology for estimating vibratory ground motion is also presented. (JWR)

16453 SEISMIC DESIGN CRITERIA FOR NUCLEAR POWER PLANTS. Jennings, P. C. (California Inst. of Tech., Pasadena); Guzman, R. A. pp 474-483 of Proceedings of U. S. National Conference on Earthquake Engineering 1975. Oakland, CA; Earthquake Engineering Research Institute (1975).

From U. S. national conference on earthquake engineering; Ann Arbor, Michigan, USA (18 Jun 1975). See CONF-7506107-.

There are three main aspects of the problem of selection of seismic design criteria for major projects such as nuclear power plants. These are the description of the appropriate level of shaking to be considered, usually given in the form of design spectra; the allowable response of the structure, usually specified in terms of allowable stresses and deflections; and the capability of the structure to dissipate energy, commonly given in the form of fractions of critical damping. In this presentation only the first of these features is examined, with particular application to nuclear powerplants. Under these restrictions, the most important parts of the problem become the determination of the amplitude of the design spectra corresponding to the safe shutdown earthquake (SSE) and the question of whether the shape of the spectra recommended by Regulatory Guide 1.60 (U. S. Atomic Energy Commission, 1973) is appropriate for the particular application. In the course of working out the details of the approach, it was found useful to reexamine a number of concepts including the use of response spectra or peak values of ground motion parameters, the shape of the design spectra, problems in attenuation and scaling, and the use of motions on the ground surface or bedrock motions. There is nothing fundamentally new in the suggested approach, although some of the features may not have been applied to the problem of selecting design spectra for nuclear powerplants in the way suggested. The approach is applied only to nuclear powerplants but it is not limited to this application. (auth)

16454 STATIC LOADS METHOD FOR SEISMIC DESIGN OF NUCLEAR POWER PLANT FACILITIES. Liao, E. N.; Marda, R. S. (United Engineers and Constructors, Inc., Philadelphia). pp 484-494 of Proceedings of U. S. National Conference on Earthquake Engineering 1975. Oakland, CA; Earthquake Engineering Research Institute (1975).

From U. S. national conference on earthquake engineering; Ann Arbor, Michigan, USA (18 Jun 1975). See CONF-7506107-.

The problem of the estimation of the response of equipment and components attached to a structure due to seismic ground disturbances has become increasingly important in nuclear power industry in recent years. This is primarily because the integrity and the safety of nuclear power plants hinges greatly on the continued operation and safe shutdown of important equipment and components such as vessels, piping, pumps, etc. during and after an earthquake. The method of equivalent static loads is essentially based upon idealizing the equipment or components as a single degree of freedom system. The equipment response based on a single degree of freedom system should be multiplied by a factor, designated as static load factor in this study. It is the main purpose of this study to find the dependence of static load factors on various parameters such as mass and stiffness characteristics and to establish the maximum values of the static load factors. Since much of the equipment and components in use for nuclear power plants are basically cantilever systems, such systems are analyzed in detail. Consideration is also given to simply supported systems. Numerical results are presented to illustrate the upper bound of the static load factor as a function of the mass ratio for two degrees as well as three degrees of freedom systems. (auth)

16455 BEHAVIOR OF CRACKED CONCRETE NUCLEAR CONTAINMENT VESSELS DURING EARTHQUAKES. Gergely, P.; Stanton, J. F.; White, R. N. (Cornell Univ., Ithaca, NY). pp 512-518 of Proceedings of U. S. National Conference on Earthquake Engineering 1975. Oakland, CA; Earthquake Engineering Research Institute (1975).

From U. S. national conference on earthquake engineering; Ann Arbor, Michigan, USA (18 Jun 1975). See CONF-7506107-.

When pressure builds up in a reinforced concrete nuclear containment shell, its cylindrical wall cracks vertically and horizontally at intervals of about five feet. If an earthquake occurs simultaneously with this pressurization, inertia forces are transmitted across the horizontal crack planes. The forces and deformations must be small enough to maintain the integrity of the steel liner. A typical containment shell has a radius of about 65 ft, and a wall thickness of about 4 ft. It is heavily reinforced with vertical, horizontal, and sometimes diagonal bars. A steel shell of about $\frac{3}{8}$ in. thickness is attached to the concrete with anchors. The seismic shear forces are transmitted across the horizontal cracks by interface shear transfer (combination of shear friction and aggregate interlocking), by dowel action of the bars, and by diagonal bars if they are used. One important question in the design of such vessels is whether the diagonal bars are necessary. In the experimental portion of the current investigation several types of tests were conducted to study the load-slip characteristics of interface shear transfer under high intensity cyclic loading. In some cases external bars provided the clamping action of reinforcement, in more recent tests large diameter embedded bars were used. This presentation summarizes the analytical part of the investigation. A representative load-slip curve has been used in the analyses to assess the intensity of the stresses and deformations, and to study the importance of the variables as an aid in planning future tests. (auth)

16456 FLOOR RESPONSE SPECTRA OF BUILDINGS WITH UNCERTAIN STRUCTURAL PROPERTIES. Chen, P. C. (Bechtel Corp., San Francisco). pp 519-528 of Proceedings of U. S. National Conference on Earthquake Engineering 1975. Oakland, CA; Earthquake Engineering Research Institute (1975).

From U. S. national conference on earthquake engineering; Ann Arbor, Michigan, USA (18 Jun 1975). See CONF-7506107-.

All Category I equipment, such as reactors, vessels, and major piping systems of nuclear power plants, is required to withstand earthquake loadings in order to minimize risk of seismic damage. The equipment is designed by using response spectra of the floor on which the equipment is mounted. The floor response spectra are constructed usually from the floor response time histories which are obtained through a deterministic dynamic analysis. This analysis assumes that all structural parameters, such as mass, stiffness, and damping have been calculated precisely, and that the earthquakes are known. However, structural parameters are usually difficult to determine precisely if the structures are massive and/or irregular, such as nuclear containments and its internal structures with foundation soil incorporated into the analysis. Faced with these uncertainties, it has been the practice to broaden the floor response spectra peaks by +-10 percent of the peak frequencies on the basis of conservatism. This approach is based on engineering judgement and does not have an analytical basis to provide a sufficient level of confidence in using these spectra for equipment design. To insure reliable design, it is necessary to know structural response variations due to variations in structural properties. This consideration leads to the treatment of structural properties as random variables and the use of probabilistic methods to predict structural response more accurately. New results on floor response spectra of buildings with uncertain structural properties obtained by determining the probabilistic dynamic response from the deterministic dynamic response and its standard deviation are presented. The resulting probabilistic floor response spectra are compared with those obtained deterministically, and are shown to provide a more reliable method for determining seismic forces. (auth)

16457 SEISMIC QUALIFICATION BY ANALYSIS OF NUCLEAR POWER PLANT MECHANICAL COMPONENTS. McDonald, C. K. (Univ. of Alabama, Birmingham). pp 529-537 of Proceedings of U. S. National Conference on Earthquake Engineering 1975. Oakland, CA; Earthquake Engineering Research Institute (1975).

From U. S. national conference on earthquake engineering; Ann Arbor, Michigan, USA (18 Jun 1975). See CONF-7506107-.

The seismic qualification of mechanical components for nuclear power plants, and for other applications such as the Alaska Pipeline, is a topic of considerable current interest. Although there is a lot of work now being done in seismic qualification throughout the country, there is very little information on the subject of analysis of mechanical components available in the open literature. The basic procedures of analysis, of course, are well known, but little help is available in developing an analytical model which will adequately predict the behavior of the mechanical component under seismic loads. Therefore, in this paper, a number of models are presented which have been extensively used for both dynamic and quasi-static seismic analysis of selected mechanical components. (auth)

16458 ROLE OF CLOSELY SPACED MODES IN THE SEISMIC RESPONSE OF EQUIPMENT AND STRUCTURES. Nelson, F. C. (Tufts Univ., Medford, MA). pp 538-543 of Proceedings of U. S. National Conference on Earthquake Engineering 1975. Oakland, CA; Earthquake Engineering Research Institute (1975).

From U. S. national conference on earthquake engineering; Ann Arbor, Michigan, USA (18 Jun 1975). See CONF-7506107-.

The genesis for this study was a need for an explanation of how to combine the peak accelerations, displacements, stresses, etc., which result from a response spectrum analysis of nuclear power plant structures and equipment. The explanation was intended to be comprehensive in the sense that it would be based on a general principle from which the absolute sum, square root of the sum of the squares (SRSS), and double-sum modal recombination rules could be extracted as special cases. The purpose of such a comprehensive explanation was to convince design engineers that these rules, in particular the recently proposed double-sum rule, were logical in their formulation and therefore sensible in their application. (auth)

Reactor Theory and Calculation

16459 (AEC-tr-7295) DISSOCIATING GASES AS HEAT-TRANSFER MEDIA AND WORKING FLUIDS IN POWER INSTALLATIONS. Materials of the All-Union Conference, January 27-30, 1969. Krasin, A. K. (ed.). (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki). 1975. Translation of Dissotsiiruyushchie gazy kak teplonositeli i Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970. (TT-72-52003; CONF-690130-). 295p. Dep. NTIS $7.60.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

The use of dissociating gases, specifically N_2O_4, Al_2Cl_6, and Al_2Br_6, in nuclear power plant primary and secondary coolant circuits is examined. Discussed are the power installations, thermodynamics, heat transfer, and gas-dynamics of the working fluids. A separate abstract was prepared for each of the 39 papers. (HDR)

For abstracts of individual papers see: 14268-14272, 14298, 14763-14773, 15223, 15224, 15585, 16282, 16355, 16460-16471, 16496, 16533, and 16539-16541.

16460 (AEC-tr-7295, pp 3-7) PROSPECTS OF USING THE DISSOCIATING GASES IN LARGE POWER STATIONS. Krasin, A. K. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli i Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

The potential for use of dissociating gases such as N_2O_4, Al_2Cl_6, and Al_2Br_6 as heat transfer media and working fluids in power plants is discussed. The applications examined include use of these gases in nuclear reactors in either the primary or secondary cooling systems. (HDR)

16461 (AEC-tr-7295, pp 8-23) THERMODYNAMIC SCHEMES AND CYCLES OF APS USING THE DISSOCIATING GASES. Nesterenko, V. B. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli i Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

The potential for improvement in the thermal efficiency of nuclear power plants by use of dissociating gases as the heat transfer medium is discussed. Prospective dissociating systems are described and their thermodynamic efficiencies are compared. (HDR)

16462 (AEC-tr-7295, pp 24-32) SOME SPECIFIC FEATURES OF THE PHYSICS OF FAST REACTORS WITH DISSOCIATING GASES AS COOLANTS. Naumov, V. A.; Slizov, V. P. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli i Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

The basic physics characteristics of dissociating gas cooled (N_2O_4 and Al_2Cl_6) reactors are compared with those of sodium cooled reactors for various core sizes. Physics characteristics of 1000 MW(e) reactors with various heat transfer media are also examined. (HDR)

16463 (AEC-tr-7295, pp 33-38) PROSPECTS OF USING THE DISSOCIATING GASES AS HEAT-TRANSFER MEDIA IN FAST NUCLEAR REACTORS. Nesterenko, V. B.; Tverkovkin, B. E.; Shinkevich, O. S. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli i Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

The physics and thermodynamic characteristics of water-cooled and sodium-cooled fast reactors are compared with those of fast reactors cooled by N_2O_4, Al_2Cl_6, and Al_2Br_6. (HDR)

16464 (AEC-tr-7295, pp 45-48) EFFECT OF HEAT OF CHEMICAL REACTION ON THE PERFORMANCE OF THERMODYNAMIC CYCLE EMPLOYING CHEMICALLY REACTING WORKING FLUIDS. Bubnov, V. P.; Zakharova, I. S.; Razumova, G. A. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli i Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

The advantages of using chemically reacting mixtures as working fluids in the thermodynamic cycles of nuclear reactors are examined. The effects of the heat of chemical reaction on the efficiency of the gas-turbine cycle and on the vapor cycle are discussed. (HDR)

16465 (AEC-tr-7295, pp 49-56) ESTIMATION OF THE THERMODYNAMIC EFFECTIVENESS OF CYCLES WORKING ON THERMALLY DISSOCIATING FLUIDS. Gokhshtein, D. P.; Verkhivker, G. P.; Tetel'baum, S. D.; Lebedev, Yu. N.; Grivanova, S. M. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli i Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

Gas cycles and vapor cycles are examined for use in nuclear power plants. The cycles use N_2O_4 as the working fluid, and their efficiencies are compared with cycles using non-dissociating gases. (HDR)

16466 (AEC-tr-7295, pp 57-64) ANALYSIS OF THE PERFORMANCE OF THERMAL POWER INSTALLATIONS WITH DISSOCIATING WORKING FLUID. Popyrin, L. S.; Starostenko, N. N. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli i Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

The method used in constructing a mathematical model of the vapor cycle of a power reactor is outlined. The heat source is a sodium cooled fast reactor using N_2O_4 in the secondary circuit. Some results of the cycle efficiency calculated with the model are presented. (HDR)

16467 (AEC-tr-7295, pp 65-68) THERMODYNAMIC ANALYSIS OF BINARY CYCLES WITH DISSOCIATING ALUMINUM CHLORIDE AS HEAT-TRANSFER MEDIUM AND WORKING FLUID. Zinov'ev, A. V.; Matyunin, A. M.; Chernobai, V. A. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli i Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

The thermodynamics of power reactor cooling systems using Al_2Cl_6 as the working fluid in the primary circuit and N_2O_4 in the secondary circuit are examined. (HDR)

16468 (AEC-tr-7295, pp 69-73) BINARY CYCLE WITH DISSOCIATING WORKING FLUID IN THE SECOND CIRCUIT OF APS WITH SODIUM-COOLED FAST REACTOR ($Na-Al_2Br_6-H_2O$). Kalafati, D. D.; Borovikova, A. M. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli i Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

A BN-350 type reactor is described in which the intermediate sodium circuit is replaced with one using dissociating Al_2Br_6 as the working fluid. The effects of this scheme on the safety and thermodynamics of the reactor are discussed. (HDR)

16469 (AEC-tr-7295, pp 74-80) GAS TURBINES WITH DISSOCIATING WORKING FLUIDS. Lomashev, B. I.; Nesterenko, V. B. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli i Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

The design and performance characteristics of large stem turbines are compared to those of turbines using N_2O_4, Al_2Cl_6, and Al_2Br_6. (HDR)

16470 (AEC-tr-7295, pp 81-89) PARAMETERS OF TURBINES FOR POWER STATIONS USING REACTING GASES AS WORKING FLUIDS. Mikhal'tsev, V. E.; Danilov, R. E.; Surovtsev, I. G. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli i Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

The effects of the number of reheats and the velocity coefficients of the turbine stages on the performance of turbines using N_2O_4 as the working fluid are presented. (HDR)

16471 (AEC-tr-7295, pp 90-99) EXPERIMENTAL STUDY OF THE THERMODYNAMIC CYCLE WITH THE DISSOCIATING GAS N_2O_4 IN EQUILIBRIUM $2NO_2$ IN EQUILIBRIUM $aNO + O_2$ AS WORKING FLUID. Nesterenko, V. B.; Lomashev, B. I.; Verzhinskaya, A. B.; Kozolovskii, V. G.; Sakovich, A. T. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli i Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

The reversibility of the dissociating gas cycle using N_2O_4 operating in the range of 20 to 600°C has been studied in the test-bed D-50. An experimental power station, Vulkan, using the N_2O_4 cycle was installed to evaluate the gas turbine and heat transfer components, to develop sealing materials, and to investigate the reversibility of the cycle. The design and operating parameters of these two installations are described. (HDR)

16472 (BNL-NCS-50451, pp 2-17) DISCREPANCIES IN THERMAL REACTOR LATTICE ANALYSIS. Rothenstein, W. (Brookhaven National Lab., Upton, NY). Mar 1975.

From Proceedings of 238U resonance capture; Upton, New York, USA (18 Mar 1975).

In seminar on the ^{238}U resonance capture. (Brookhaven National Lab., Upton, N. Y. (USA)).

Experience gained over recent years has shown that the consistent use of ENDF/B data leads to discrepancies, when the results of analysis of thermal reactor lattices containing Uranium fuel of low enrichment are compared with experiment. Typically the effective multiplication factor is less than unity by one or two percent, and even as much as three percent for very tight water moderated lattices. Similar trends have been observed by investigators at Winfrith using their multigroup data. The previous studies of clean thermal reactor lattices are reviewed. The principal features of the calculational methods, which make full use of ENDF/B data, are outlined and compared with other treatments specially as regards the resonance capture calculations. The information which can be obtained from comparisons of measured integral lattice parameters and their calculated values is discussed, together with attempts which have been made to use this information to reduce or eliminate the gap between theory and experiment. (auth)

16473 (BNL-NCS-50451, pp 72-80) ANALYSIS OF THE "FOUR-FUEL" EXPERIMENTS USING HAMMER. Craig, D. S. Mar 1975.

From proceedings of 238U resonance capture; Upton, New York, USA (18 Mar 1975).

In seminar on the ^{238}U resonance capture. (Brookhaven National Lab., Upton, N.Y. (USA)).

Measurements which have been made at Chalk River on a series of 37 element clusters using different fuels—UO_2, UC, U-Si-Al, and U are described. The cluster geometry was identical for all fuels, the moderator was D_2O and measurements were made using four different coolants—air, D_2O, H_2O, and HB40 (an organic). The Savannah River Laboratory cell code HAMMER and the ENDF/B-IV data for ^{235}U and ^{238}U were used to calculate parameters for these lattices. (auth)

16474 (BNL-NCS-50451, pp 215-221) TECHNIQUE FOR SIMULTANEOUS ADJUSTMENT OF LARGE NUCLEAR DATA LIBRARIES. Harris, D. R.; Wilson, W. B. (Los Alamos Scientific Lab., CA). Mar 1975.

From proceedings of ^{238}U resonance capture; Upton, New York, USA (18 Mar 1975).

In seminar on the ^{238}U resonance capture. (Brookhaven National Lab., Upton, N.Y. (USA)).

Adjustment of the nuclear data base to agree with integral observations in design work has been limited in part by problems in the required inversion of matrices. It is shown that this inversion problem can be circumvented and arbitrarily large nuclear data libraries can be adjusted simultaneously when the basic data are uncorrelated. The technique is illustrated by adjusting nuclear data to integral observations made on fast reactor benchmark critical assemblies. 3 tables. (SDF)

16475 (CONF-751071-1) APPLICATION OF THE FORSS SENSITIVITY CODE SYSTEM TO FAST REACTOR ANALYSIS. Weisbin, C. R.; Oblow, E. M.; Mynatt, F. R. (Oak Ridge National Lab., Tenn. (USA)). 22 Oct 1975. 22p. Dep. NTIS $4.50.

From meeting of the cross section evaluation working group; Upton, New York, USA (22 Oct 1975).

The FORSS Sensitivity Analysis Code System is described in terms of its objectives and present capabilities. An example is made of a problem specified by the Processing Methods Testing Subcommittee of the Code Evaluation Working Group, i.e., the determination of integral parameters, sensitivities to cross-section data, methods and data uncertainties, and required cross-section accuracies for an infinite media of ZPR 6/7 core composition. (auth)

16476 (COO-3021-10) FINAL REPORT [ON SOLVING THE MULTIGROUP DIFFUSION EQUATIONS]. Birkhoff, G. (Harvard Univ., Cambridge, Mass. (USA)). 1975. Contract E(11-1)-3021. 5p. Dep. NTIS $3.50.

Progress achieved in the development of variational methods for solving the multigroup neutron diffusion equations is described. An appraisal is made of the extent to which improved variational methods could advantageously replace difference methods currently used. (DG)

16477 (EIR-290) QP1, A TRANSPORT PROGRAM IN x-y GEOMETRY BASED ON FUNCTION EXPANSIONS IN ANGLE AND SPACE. Maeder, C. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Sep 1975. 35p. (CONF-751152-1). Dep. NTIS (US Sales Only) $5.00.

From IAEA specialist meeting on methods of neutron transport theory in reactor calculations; Bologna, Italy (3 Nov 1975).

A method for solving the neutron transport equation in x-y geometry is described. In the interior and on the boundary of a mesh the flux depends linearly on the space variables. The angular dependence is represented by a quadruple P_1 expansion. The inner flux moments are determined from the basic form of the transport equation, while the mesh leakage is cal-

culated by means of transmission and escape probabilities which are derived from the integral equation. Neighbouring meshes are connected by requiring continuity of the angular current moments. Results calculated with the code QP 1, which is based on this theory, depend only slightly on the chosen mesh division, and they are in good agreement with more exact calculations. (auth)

16478 (FRNC-TH-549) REACTOR PHYSICS. Application of the Synthesis Method to Spatial Kinetics. Chattas, S. F. (Paris-11 Univ., 91-Orsay (France)). 1975. vp. (In French). INIS.

CINTAX is a code used to study reactor projects; it is particularly suitable for safety studies which involve very pronounced three-dimensional phenomena (axial phenomena). The discontinuous synthesis method used in CINTAX allows for relatively long time steps. The spatial kinetic method of synthesis is based on a variational form of the time-dependent diffusion equation. It is possible to write a Roussopoulos functional of which the stationary state condition is equivalent to the time-dependent diffusion equation and to delayed neutron percursor equations. If the time-dependent flux is developed on an incomplete basis the conventional kinetic synthesis equations are obtained. The coupling coefficients are determined using functions associated preferably with direct fluxes (Galerkin method). In the model proposed the test functions necessary are calculated under static conditions using the method of finite differences, then the time-dependent coupling coefficients are computed by means of the functionals defined above. Finally by combining test function and coupling coefficients the synthesis of the solution at the moment considered is obtained. (FR)

16479 (IBK-1300) EXPERIMENTAL DETERMINATION OF MATERIAL BUCKLING IN FAST REACTORS. Program BUCKLING. Soticj, M. O. (Institut za Nuklearne Nauke Boris Kidric, Belgrade (Yugoslavia)). 1974. 27p. INIS.

The developed method for determination of material buckling in fast reactor systems has been analyzed and some improvements made. The non-cylindrical shape of the reactor core is taken into account and the linear correlation between experimental and theoretical reaction rate traverses has been thoroughly studied. The corresponding computer program BUCKLING is written and applied to measurements in the fast reactor assembly SNEAK-7A in Karlsruhe. The evaluation of measurements was performed with the latest cross-section sets available at the Kernforschungszentrum in Karlsruhe. (INIS)

16480 (IFA-FR-141-1975) GEOMETRIC DIMENSIONS OF AN ALTERNATIVE NUCLEAR ENGINE AND THE COEFFICIENT OF VARIATION WITH REGARD TO ONE-DIMENSION OF THE NEUTRONS MULTIPLICATION FACTOR. Cristea, G.; Gheorghiu, N. (Institutul de Fizica Atomica, Bucharest (Romania)). 1975. 26p. Dep. NTIS (US Sales Only) $4.00.

The geometric dimensions of a nuclear reactor engine for the time period when it supplies the energy are calculated. The variation of the neutron multiplication factor when the reactor passes from the critical to the supercritical state is analyzed. (auth)

16481 (INR-1482/9A/PR/B) INVESTIGATIONS OF STATIC PARAMETERS OF REACTOR LATTICES WITH MULTITUBE ENRICHED FUEL. Jozefowicz, E. T. (Institute of Nuclear Research, Warsaw (Poland)). 1973. 191p. (In Polish). INIS.

The report is the compilation of the experimental investigations performed during last few years of the basic physical static parameters of reactor cores built of multitube enriched fuel of WWR-SM and ANNA types (the MR type fuel is also included in the considerations). The cores constructed incorporated different moderators with various fuel-to-moderator volume ratio. These investigations included elaboration of new methods or adaptation of earlier known ones to the measurements of the following core parameters: distribution of thermal neutron flux density in the elementary cell-leading to the thermal utilization factor; spectral indices; resonance absorption ratio in ^{238}U leading to the resonance escape probability; epithermal fission ratio in ^{238}U; ^{238}U to ^{235}U fission ratio leading to the value of the fast fission coefficient;initial conversion ratio. Moreover, the measurements of critical masses and macroscopic neutron flux distributions are shortly described. The measured parameters are also compared with corresponding calculations, in most cases very simple ones, partially analytical. The investigated parameters were interpreted in the frames of infinite multiplication coefficient and two-group critical equation. The applicability of such models and methods of estimation for the investigated lattices has been checked. Special attention was paid to the measurements and calculations of microdistribution of thermal neutron flux in the elementary cells with very complicated structure and to the influence of high degree of heterogeneity of the system on some basic static parameters. (auth)

16482 (INR-1487/9/R/B) APPLICATION OF THE DIRECT VARIATIONAL METHOD TO THE DETERMINATION OF THE TEMPERATURE FIELD IN A TWO COMPONENT SYSTEM. Lach, J. (Institute of Nuclear Research, Warsaw (Poland)). 1973. 35p. (In Polish). INIS.

An application of the direct variational method to analysis of the heat exchange between a circular rod with internal heat sources and a coolant is presented. The integral Laplace transform was also used. As a result of this analysis analytical expressions describing the temperature field in the rod and the coolant were obtained. (auth)

16483 (JPNRSR-12) CALCULATION OF RADIONUCLIDE YIELDS IN COMPLEX DECAY, ACTIVATION, AND FISSION AT ANY GIVEN TIME (CODAC CODE). Takeda, T. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). 14 May 1975. Translation of JAERI-M-6148. 54p. Dep. NTIS $4.50.

Work performed under United States Nuclear Regulatory Commission--Light Water Reactor Safety Technical Exchange Program.

A code for calculating radioactive nuclide yield in complex decay processes is developed. This code makes possible the calculation of yields from decay chains associated with activation and fission by the use of simple input. It can also readily accomodate FP release without having to disregard the presence of parent nuclides. 11 references. (auth)

16484 (LA-6152-MS) NEUTRONIC REBALANCE ALGORITHMS FOR SIMMER. Soran, P. D. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1975. Contract W-7405-eng-36. 25p. Dep. NTIS $4.00.

Four algorithms to solve the two-dimensional neutronic rebalance equations in SIMMER are investigated. Results of the study are presented which indicate that a matrix decomposition technique with a variable convergence criterion is the best solution algorithm in terms of accuracy and calculational speed. Rebalance numerical stability problems are examined. The results of this study can be applied to other neutron transport codes which use discrete ordinates techniques. (auth)

16485 AMERICAN NATIONAL STANDARD NUCLEAR DATA SETS FOR REACTOR DESIGN CALCULATIONS. ANSI-N411-1975. New York; American Nuclear Society (1975). 21p. (ICONS-02094). $12.50.

A standard is presented which identifies and describes the specifications for developing, preparing, and documenting nuclear data sets to be used in reactor design calculations. The specifications include (a) criteria for acceptance of evaluated nuclear data sets, (b) criteria for processing evaluated data and preparation of processed continuous data and averaged data sets, and (c) identification of specific evaluated, processed continuous, and averaged data sets which meet these criteria for specific reactor types. (auth)

16486 DETERMINATION OF THE DISTRIBUTION FORMULA OF THE COUNTS IN THE NOISE EXPERIMENTS FROM THE FORWARD CHAPMAN-KOLMOGOROV EQUATION. Cristea, G. (Inst. of Atomic Physics, Bucharest). Rev. Roum. Phys.; 20: No. 4, 403-414(1975).

The theoretical relations from the forward Chapmann-Kolmogorov equation is obtained for the events distribution registered into the detectors in the noise experiment in the point reactor model and using the approximation of the uniform detector distribution with their macroscopic cross section. The aim of this paper is the research of the possibility to realize a solving programme of the forward Chapmann-Kolmogorov equation with many variables to interpret the experimental noise data. (auth)

16487 GENERAL METHOD OF DETERMINING EFFECTIVE CROSS SECTIONS FOR HETEROGENEOUS MEDIA. Kirby, K. D.; Karam, R. A. (Georgia Inst. of Tech., Atlanta). pp 182-195 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

Effective resonance cross sections for heterogeneous media are determined by a general cross section averaging method which can account for spatial nonuniformity in the neutron source distribution. A generalized reciprocity relation and energy-dependent escape cross section form the basis of the method which is applied to the analysis of a typical fast reactor critical assembly. Compensating effects due to nonuniformity in

the parameters of the general method are observed and discussed. (auth)

16488 ENERGY DEPENDENT FINE-STRUCTURE EFFECTS ON THE REACTIVITY WORTH OF RESONANCES. Greenspan, E. (Nuclear Research Center, Beersheba, Israel). pp 196-205 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

The effects of perturbations in the fine-structure of the neutron spectrum on the reactivity worth of resolved resonances are investigated using a simple, space independent model, amenable to analytic solution. It is found that the spectral fine-structure effects can contribute significantly to the reactivity worth of a resonance. The multigroup perturbation theory calculation methods commonly used do not account adequately for these fine structure effects. These calculations can overpredict the reactivity worth of a resonance by up to a factor of 2, for even infinitesimal perturbations. The connection between the spectral fine-structure effects and the central worth discrepancy is discussed. (auth)

16489 EQUATIONS OF DYNAMICS FOR A THREE-DIMENSIONAL HETEROGENEOUS REACTOR. Roumiantsev, A. N. (Inst. of Atomic Energy, Moscow). pp 224-235 of Advanced Reactors; Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

A description is presented of a method of digital calculation of the neutron kinetics of a three-dimensional heterogeneous reactor of the pressure tube type. The basis of the method consists of the Feinberg-Galanin method of calculating heterogeneous reactors, which was developed for three-dimensional analysis. It is assumed that time-dependent changes of the characteristics of the fuel rods of the reactor (the pressure-tube channels containing fuel and control rods) which depend on the distributions of temperature and of coolant densities are described by well-known time functions. For the analysis of "slow" non-stationary processes in multi-channel coolant loops, there is proposed a method for computation of the dynamic distributions of temperatures in the fuel elements and in the moderator, and the distributions of flow rates, and enthalpies and other parameters of the coolant are determined from examination of steady-state modes of operation of the channel. (auth)

16490 ESTIMATION OF DESIRED ACCURACY OF NUCLEAR DATA FOR FAST REACTOR DESIGNS. Maki, K. (Nuclear Energy Research Lab., Kawasaki, Japan); Yamamoto, M.; Kinjo, K. pp 452-467 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

A discussion is presented of the estimation of the desired accuracies of nuclear data based on the method which will give rather realistic desired accuracies of nuclear data under the consideration of not only sensitivity coefficients but also present uncertainties and attainable accuracies of nuclear data. Based on the results of the estimation of the desired accuracies, the priorities of the necessities of further evaluation works for nuclear data are determined by the ratio of the present uncertainties to the desired accuracies of nuclear data. The nuclear data with the highest priority for further evaluation works are listed. (auth)

16491 SPATIAL DEPENDENCE OF BROAD GROUP CROSS SECTION. Mildrum, C. M.; Karam, R. A. (Georgia Inst. of Tech., Atlanta). pp 491-502 of Advanced Reactors: Physics, Design, and Economics. Kallfelz, J. M. (ed.). Oxford; Pergamon Press Ltd. (1975).

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974). See CONF-740903-.

The influence of resonance structure and non-separability of the flux as a function of space and energy on the spatial dependence of broad group cross sections was studied in a one-region, demonstration-plant-size, fast reactor. (auth)

16492 GENERALIZED BILINEAR WEIGHTING FOR MULTIGROUP CROSS-SECTION COLLAPSING. Salvatores, M. (Comitato Nazionale per L'Energia Nucleare, Casaccia, Italy). Nucl. Sci. Eng.; 57: No. 4, 340-344 (Aug 1975).

A new multigroup cross-section collapsing procedure is described in the framework of the generalized perturbation theory. Numerical examples suggest its use, in addition to the standard linear flux and bilinear real-flux/adjoint-flux weighting procedures, when reactivity coefficients, such as the sodium void coefficient, are to be preserved in a few-group model. (auth)

16493 NEW DEFINITION OF THE CELL DIFFUSION COEFFICIENT. Koehler, P. (Swiss Federal Inst. for Reactor Research, Wuerenlingen). Nucl. Sci. Eng.; 57: No. 4, 333-344 (Aug 1975).

As was shown in a recent work by Gelbard, the usually applied Benoist definition of the cell diffusion coefficient gives two different values if two different definitions of the cell are made. A new definition is proposed that preserves the neutron balance for the homogenized lattice and that is independent of the cell definition. The resulting diffusion coefficient is identical with the main term of Benoist's diffusion coefficient. (auth)

16494 EXTENDED P/SUB L/ APPROXIMATION OF THE MULTIDIMENSIONAL NEUTRON TRANSPORT EQUATION. Sigg, B. (Swiss Federal Inst. of Tech., Zurich). Nucl. Sci. Eng.; 57: No. 4, 277-291 (Aug 1975).

A modified truncation of the P/sub l/ equations for the treatment of multidimensional time-dependent neutron transport is presented that avoids some inconvenient features of the usual P/sub L/ approximation, such as the nonuniqueness of the stationary equations in vacuum and the discontinuity of certain moments at material interfaces. The mathematical properties of the original (P/sub L/) and modified (EP/sub L/) approximations, together with interface and vacuum boundary conditions, are compared. An approximate solution method for both types of equations is derived from a variational principle, and numerical results are given for time-dependent P_l and EP_l calculations in two-dimensional cylindrical geometry. (auth)

16495 REACTIVITY OF HAFNIUM IN CONTROL RODS. A Study at the Critical Experiment KAHTER. Drueke, V.; Gerwin, H.; Jonas, H.; Krings, F. J.; Rueckert, M.; Scherer, W. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorentwicklung). Atomkernenergie; 26: No. 2, 145-146 (1975). (In German)

1 fig.; 2 tabs.; 9 refs.

In the THTR-300 prototype high-temperature reactor, absorbing balls containing HfC as a burnable neutron poison will be used. Due to the multiplicity and variety of the hafnium isotopes — some of which are powerful resonance absorbers — calculating models as well as cross section data were unreliable with regard to the reactivity effects of hafnium. Reactivity measurements were therefore carried out on a special HfC-filled absorber rod in core figuration III (3 moderator elements to 1 AVR type fuel element) at the critical experiment KAHTER. In order to acquire data on the resonance self-absorption, 3 different concentrations of HfC and 3 similar dilutions on B_4C were studied. Calculations on the measurements were carried out following the experiments. (DE)

Reactor Components and Accessories

Refer also to abstracts 14763, 14764, 15227, 15270, 15328, and 15353.

16496 (AEC-tr-7295, pp 104-108) SEALS AND BEARINGS FOR ROTATING SHAFTS OF APS WITH DISSOCIATING GAS AS WORKING FLUID. Krevsun, E. P.; Gorodetskii, M. E.; Il'in, A. Ya. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli i Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

Problems in the development of seals for turbines and pumps using N_2O_4 are discussed, and test results on various types of seals and seal material are described. Plans for testing high-speed bearings are discussed. (HDR)

16497 (CONF-751137-1) SUMMARY AND ACCOMPLISHMENTS OF THE ORNL PROGRAM FOR NUCLEAR PIPING DESIGN CRITERIA. Greenstreet, W. L. (Oak Ridge National Lab., Tenn. (USA)). Nov 1975. 14p. Dep. NTIS $4.50.

From meeting on methods for analyzing piping integrity; Germantown, Maryland, USA (11 Nov 1975).

The ORNL Piping Program was defined and established to develop basic information on the structure behavior of nuclear power plant piping components and to prepare this information in forms suitable for use in design codes and standards. Charts are presented showing the percentage completion of the various program tasks. (DG)

16498 (CONF-751149-1) CONTRIBUTIONS OF THE ORNL PIPING PROGRAM TO NUCLEAR PIPING DESIGN CODES AND STANDARDS. Moore, S. E. (Oak Ridge National Lab., Tenn. (USA)). Nov 1975. 11p. Dep. NTIS $4.50.

From safety technology meeting for analyzing piping integrity; Germantown, Maryland, USA (11 Nov 1975).

The ORNL Piping Program was conceived and established to develop basic information on the structural behavior of nuclear power plant piping components and to prepare this information in forms suitable for use in design analysis and codes and standards. One of the objectives was to develop and qualify stress indices and flexibility factors for direct use in Code-prescribed design analysis methods. Progress in this area is described. (auth)

16499 (CONF-751149-2) VERIFICATION AND QUALIFICATION OF INELASTIC ANALYSIS COMPUTER PROGRAMS. Corum, J. M. (Oak Ridge National Lab., Tenn. (USA)). Nov 1975. 8p. Dep. NTIS $4.50.

From safety technology meeting for analyzing piping integrity; Germantowm, Maryland, USA (11 Nov 1975).

The use of computer programs that employ relatively complex constitutive theories and analysis procedures to perform inelastic design calculations introduces questions of validation and acceptance of the analysis results. In order to check the validity of predicted inelastic responses of simple structures made of type 304 stainless steel, comparisons are made between predicted and measured inelastic responses. Results indicate that the basic trends and features of the inelastic responses are predicted with generally good accuracy. (DG)

16500 (EUR-5334e) INVESTIGATIONS ON RADIOACTIVE FISSION PRODUCT CORRELATIONS: γ SPECTROMETRY MEASUREMENTS ON SPENT FUEL ASSEMBLIES DISCHARGED FROM THE TRINO VERCELLESE REACTOR AT THE END OF THE 2ND IRRADIATION CYCLE. Bresesti, A. M.; Bresesti, M.; Cuypers, M.; D'Adamo, D.; Lezzoli, L.; Bannella, R.; Giuriato, A.; Paoletti Gualandi, M.; Peroni, P. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1975. 50p. Dep. NTIS (US Sales Only) $5.00. EUR FB 140,-.

In the framework of a cooperation program between ENEL and EURATOM, γ spectrometry measurements were performed on 12 fuel assemblies of the Trino Vercellese PWR, to study the correlations existing between radioactive fission products and the burnup and plutonium content. A mechanical and collimation system permitted measurements to be performed at different levels on the four corners of the fuel assemblies in the spent fuel pool of the Trino Vercellese plant. γ spectrometry measurements were also carried out on solutions of the Trino Vercellese fuel, taken at the input of the Eurochemic reprocessing plant. The γ ray activities of the fission products were correlated with values of burnup and plutonium content generated by the BURSQUID, a two-dimensional diffusion burnup code, and with values of plutonium content determined by means of chemical analyses at the input of the reprocessing plant. (auth)

16501 (EUR-5340e) SUGGESTIONS FOR THE INTERPRETATION OF TEMPERATURE NOISE MEASUREMENTS IN A HEATED LINEAR BUNDLE IN A WATER LOOP. Schwalm, D. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1975. 33p. Dep. NTIS (US Sales Only) $5.00. EUR FB 110,-.

A concept is described how to use temperature noise for the detection and identification of a simulated malfunction (e.g. a blockage) in a heated linear bundle in the preboiling state. At first methods are proposed how to find an optimal detector position down stream from the bundle exit in such a way that the detector "sees" the total bundle cross section. In addition some methods are proposed for the identification of the malfunction by making use of random data analysis. 14 references. (auth)

16502 (HHR-1) COMPOSITE STEEL PANELS FOR TORNADO MISSILE BARRIER WALLS. Topical Report. (Robertson (H. H.) Co., Ambridge, Pa. (USA)). Oct 1975. 40p. H. H. Robertson Co., Ambridge, PA.

A composite steel panel wall system is defined as a wall system with concrete fill sandwiched between two steel layers such that no concrete surface is exposed on the interior or the exterior wall surface. Three full scale missile tests were conducted on two specific composite wall systems. The results of the full scale tests were in good agreement with the finalized theory. The theory is presented, and the acceptance of the theory for design calculations is discussed.

16503 (INR-1491/11/E/B) REACTOR POWER METER. Glowacki, S. W. (Institute of Nuclear Research, Warsaw (Poland)). 1973. 17p. (In Polish). INIS.

The principle and some electronic circuits of the Reactor Power Meter developed in Reactor Operation Dept. of INR are described. The gamma activity of reactor cooling water is measured by pressurized ionisation chamber. The output current drives the analog-to-digital converter and is converted into the series of output pulses. The signal frequency depends linearly on the intensity of converter input current. The output pulses are counted by a gate scalar. The amount of pulses stored during one cycle gives information about the actual reactor power. (auth)

16504 (ORNL-5044(Vol.3)) STRESS ANALYSES OF FLAT PLATES WITH ATTACHED NOZZLES, Vol. 3, Experimental Stress Analyses of a Flat Plate with Two Closely Spaced Nozzles of Equal Diameter Attached. Bryson, J. W.; Swinson, W. F. (Oak Ridge National Lab., Tenn. (USA)). Dec 1975. Contract W-7405-eng-26. 386p. Dep. NTIS $10.60.

The complete test results for a flat plate with two closely spaced nozzles attached are presented. Test loadings were 1:1, 1:2, and 2:1 biaxial planar tension loadings on the plate, axial thrust loadings applied separately to the nozzles, and bending moment loadings applied to the nozzles both within and normal to the plane of symmetry containing the nozzle axes. The test plate was 36 x 36 x 0.375 in., and the attached nozzles had outer diameters of 2.625 in. and wall thicknesses of 0.250 in. The nozzles were located in the center of the plate with their centers 3.0 in. apart and were considered to be free of weld distortions and irregularities in the junction region. 6 references. (auth)

16505 ROTTERDAM NUCLEAR. Atoomenerg. Haar Toepass.; 17: No. 10, 214-216(Oct 1975).

In 1965 Rotterdam Nuclear received an order for the design, supply of materials, manufacture, testing, inspection and preparation for shipment of one 450MW boiling water reactor pressure vessel. This was one of the first orders for a reactor pressure vessel, ever obtained by a European manufacturer. The company has since supplied 19 reactor pressure vessels for nuclear power stations, having a total weight of about 10,000,000kg. The nuclear power stations in which these are installed represent an electrical output of about 15,000MW and they are located in seven different countries (USA, Spain, Switzerland, Argentina, Sweden, Germany and the Netherlands). (NL)

16506 DIKKERS VALVES FOR NUCLEAR INDUSTRY. Atoomenerg. Haar Toepass.; 17: No. 10, 218-219(Oct 1975).

Most countries have adopted the ASME Boiler and Pressure Vessel Code Section III, as the basis of their national requirements for licensing nuclear components. This Code gives clear directives for defining design requirements coupled with a controlled manufacturing system. Dikkers manufactures nuclear products in accordance with this Code, Section III; indeed many features exceed these minimum requirements. (NL)

16507 NUCLEAR ACTIVITIES OF ROYAL SCHELDE. Atoomenerg. Haar Toepass.; 17: No. 10, 220-222(Oct 1975).

Royal Shelde is a large engineering company and a member of the Rhine-Schelde-Verolme Group, having about 4000 people working in five departments, among which is the nuclear department. This department employs about 200 specialists, being active in the following fields: development, design and fabrication of components, particularly for sodium-cooled fast breeder reactors and components/systems, together with uranium enrichment plants, such as: heat exchangers, steam generators, cold-traps, pressure vessels, condensers, special valves, piping, cascade-piping, systems, desublimers, containers for waste storage, experimental loops, in-pile components, irradiation channels, grids for fuel elements etc. (NL)

16508 CIRCULAR OR POLYGONAL VESSEL AND A SUPPORT ARRANGEMENT THEREFOR. Muto, K.; Hisada, T. (to Kajima Corp.). British Patent 1,396,962/B/. 11 Jun 1975. Filed date 24 Jul 1972. 5p.

Reference is made to prestressed concrete reactor pressure vessels as used in Japan. Such vessels are provided with sliding bearing means to take care of deformations of the vessel due to such factors as prestress and variations in pressure and temperature within the vessel. This supporting means, however, does not ensure safety of the vessel against horizontally imparted forces such as due to earthquakes. In the arrangement described the support arrangement comprises at least three support blocks located

beneath the bottom of the main structure, each block including two members connected by shear key portions extending in the radial direction. Some alternative structural arrangements are also described. (UK)

16509 TESTING OF NUCLEAR AIR-CLEANING SYSTEMS. ANSI N510-1975. New York; American Society of Mechanical Engineers (1975). 20p. (ICONS-02077).

A standard is presented which describes methods for field-testing nuclear power plant air cleaning systems. Included are specifications for visual inspection; duct and housing leak test; mounting frame pressure leak test; airflow capacity, distribution, and residence time tests; air-aerosol mixing uniformity test; in place leak test of HEPA filter banks; multiple sampling technique; in-place leak test of adsorber stage; laboratory testing of adsorbent; and duct heater performance test. (DG)

16510 A DEVICE FOR SEALING AND HEAT INSULATING A PIPE CONTAINING A PRESSURIZED HOT FLUID. Costes, D. (to CEA). French Patent 2,228,188/A/. 6 Feb 1973. 8p. (In French)

Description is given of a device for sealing and heat insulating pipes. This device comprises: an inner coating for the pipe, said coating being made of a rigid heat insulating material; a cylindrical metal sheet with a corrugated cross section fully covering the heat insulating coating, the latter comprising corrugations similar to those of the metal sheet; means for anchoring the metal sheet to a cold structure, arranged radially with respect to the pipe, each of said means being integral with a respective through of metal sheet, at one end thereof and integral with the cold structure, at the other end thereof. This device can be applied to water cooled nuclear reactor hot pipes. (FR)

16511 UP TO DATE CRITERIA FOR SAFETY ANALYSIS OF PRESSURE VESSELS IN THE NUCLEAR FIELD. Roche, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Div. d'Etude et de Developpement des Reacteurs). Rev. Fr. Mec.; No. 50, 45-61(1974). (In French)

Traditional criteria are based on the comparison of elastic stress calculation results and data supplied by the simple traction test. In fact they only allow a very rough safety estimate since they neglect the actual behavior of the materials. What is more the calculated stresses depend a great deal on the computing process chosen. It is shown that new criteria should be preferred, based on potential damage to the apparatus and the modes of breakdown liable to result. The most frequent types of damage are then examined: excessive deformation, plastic instability, gradual deformation, oligocyclic fatigue and sudden failure. These new criteria afford a more thorough estimation of the safety of pressure equipment. (FR)

16512 THE SAFETY WITHIN THE CONSTRUCTION OF PRESSURE VESSELS. An Evaluation of the Design Methods. Pellissier Tanon, A. (Societe Creusot-Loire, 75-Paris (France)). Rev. Fr. Mec.; No. 50, 63-68(1974). (In French)

The technical construction factors on which the safety of pressure equipment depends and the conditions under which an analysis accounting for modes of damage or breakdown can be used to check the safety of such equipment are discussed. (FR)

16513 CRITICAL VIEW ON POWER PLANT PIPELINES. Eiden, H. (Technischer Ueberwachungs-Verein Rheinland e.V., Koeln (F. R. Germany). Fachbereich Dampf- und Drucktechnik); Vorwerk, K. (Technischer Ueberwachungs-Verein Rheinland e.V., Koeln (F. R. Germany). Abt. Grosskraftwerke). pp 133-149 of Power Plant Engineering. Reliability Enhancement and Operation Optimization. Koeln, F. R. Germany; TUeV Rheinland (1974). (In German)

From symposium "Power plant engineering-Reliability enhancement and operation optimization"; Bad Neuenahr, F. R. Germany (7 Oct 1974). 17 figs.; 6 refs.

By means of statistical and analytical examinations the main contributory effects for damages on power plant pipelines are demonstrated. Quantitative statements for a nuclear power plant on a larger scale are made and important parameters considered. Conclusions are drawn from that concerning planning and layout, building and operation. (DE)

16514 PROBE FOR RADIATION MEASUREMENT, PARTICULARLY INSIDE THE CORE OF NUCLEAR REACTORS. Foster, R. G.; Cyboron, R. D. (to Combustion Engineering, Inc., Windsor, Conn. (USA)). German(FRG) Patent 2,438,768/A/. 6 Mar 1975. 17p. (In German)

The probe is to measure the neutron flux inside the core of nuclear reactors. It consists of the electrical parallel circuit of a collectron (β flow neutron detector) with a fission chamber. The parallel circuit is a result of the mechanical joining of two head ends of the tubular outer electrodes of about the same diameter and of the inner electrodes. These are designed as inner conductors. Thus one achieves that only two conductors must be lead out of the core of the reactor. The mechanical joint is a welding or hard brazing joint. (DE)

16515 FORCES AND THEIR VALUATION FOR PIPELINES. Bechler, E. (Babcock-Brown Boverie Reaktor G.m.b.H., Mannheim (F. R. Germany). Abt. Kraftwerke Maschinentechnik). pp 119-132 of Power Plant Engineering. Reliability Enhancement and Operation Optimization. Koeln, F. R. Germany; TUeV Rheinland (1974). (In German)

From symposium "Power plant engineering-Reliability enhancement and operation optimization"; Bad Neuenahr, F. R. Germany (7 Oct 1974). 11 figs.

A live steam pipe is used to demonstrate its construction according to plan. Contributory effects, e.g., varying tolerances in tube walls, inclined positions of pipe hangers, are examined and data presented. For comparison different methods are used to ascertain and judge the tensile properties. (DE)

16516 LIFETIME OF SUPERHEATED STEAM COMPONENTS. Stoklossa, K. H. (Technischer Ueberwachungs-Verein Rheinland e.V., Koeln (F. R. Germany). Dienststelle Wuppertal); Oude-Hengel, H. H.; Kraechter, H. J. (Technischer Ueberwachungs-Verein Rheinland e.V., Koeln (F. R. Germany). Abt. Grosskraftwerke). pp 99-118 of Power Plant Engineering. Reliability Enhancement and Operation Optimization. Koeln, F. R. Germany; TUeV Rheinland (1974). (In German)

From symposium "Power plant engineering-Reliability enhancement and operation optimization"; Bad Neuenahr, F. R. Germany (7 Oct 1974). 19 figs.; 5 tabs.; 9 refs.

The current evaluation schemes in use for judging the lifetime expectations of superheated steam components are compared. The influence of pressure and temperature fluctuations, the differences in the strength of the wall, and the spread band of constant strain rates are critically investigated. The distribution of these contributory effects are demonstrated in the light of numerous measuring results. As an important supplement to these evaluation schemes a newly developed technique is introduced which is designed to calculate failure probabilities. (DE)

16517 PRACTICE ORIENTED RELIABILITY OPTIMIZATION OF TECHNICAL SYSTEMS. Schneeweiss, W. (Siemens A. G., Karlsruhe (F. R. Germany). Abt. Energietechnik-Systemtechnische Entwicklung). Angew. Inf.; 17: No. 9, 369-374(Sep 1975). (In German)

4 figs.; 2 tabs.; 6 refs.

Aspects of a practice-oriented optimization of the reliability and MTBF of repairable technical systems by modest application of redundancy are discussed. The result is a simple search algorithm, the flow of which is demonstrated by aid of a small example. (DE)

16518 HOLLOW GUIDE BAR FOR THE CHARGING SYSTEM OF A NUCLEAR REACTOR. Hoffmeister, B. (to Krupp (Friedr.) GmbH). German(FRG) Patent 2,356,503/A/. 22 May 1975. 11p. (In German).

4 figs.

Technical data of a hollow guide bar which consists of parts which are put into each other and through the inside of which a gripper element can be slid are given. (DE)

Reactor Fuels

Refer also to abstract 15178.

16519 (ANL-75-59) THEORETICAL ASSESSMENT OF SOME OF THE EFFECTS OF FISSION-INDUCED IMPURITIES ON THE CREEP BEHAVIOR OF MIXED-OXIDE FUEL. Singh, R. N. (Argonne National Lab., Ill. (USA)). Oct 1975. Contract W-31-109-Eng-38. 16p. AT.

A theoretical assessment of the effects of solid fission products on the creep behavior of mixed-oxide fuel elements is reported. The effects of fission products on important physical properties of the materials, such as diffusion and dislocation motion, are discussed. These properties are related to creep in terms of (1) the generation of both lattice defects and localized lattice strain and (2) the physical state and location of fission-product clusters. 16 references. (auth)

16520 (CNLM-5943) BINARY GAS CONTROLLED INPILE CAPSULE-STUDY. Ackermann, W. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 26 Oct 1964. 4p. Dep. NTIS $3.50.

Declassified 12 Jan 1976.

Heat transfer analysis shows that a 2200°F binary gas controlled capsule is feasible for operation at fuel power densities

of 0.27 to 0.53 and 1.04 to 2.49 kW/cc. He and Ar are used as the gases. (DLC)

16521 (INIS-mf-1781) FISSION GASES IN FUEL RODS. Olezza, R. L. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). 1974. 54p. (In Spanish). INIS.

A brief summary is given of the current knowledge on fission gases, the mechanisms producing them, and the methods and techniques used for their measurement and analysis. The importance of studying fission gases in fuel rods containing UO_2 or $(U-Pu)O_2$ is emphasized. The data presented should be sufficient to define and evaluate irradiation tests of prototypes and to indicate future lines of investigation. (JSR)

16522 (KFK-2163) FUEL PIN DESIGN AND CONTROL PROGRAM SYSTEM MERKUR. Steinbock, L. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung). Jul 1975. 31p. (In German). Dep. NTIS (US Sales Only) $5.00.

An interactive APL-program system for pin design and specification was developed, which only needs limited activities of the user. All material properties, which are frequently used, are selected by key words from a data bank, i.e., for the clad material "1.4970" and are built into the program. At the time being the program gives an accurate thermal and neutronic and a rough mechanical specification for the pin with prescribed values for the plutonium distribution and stoichiometry distribution. The nuclear specification comprises a one group transport calculation from the clad surface inward. The system contains in addition to the calculational programs some conversational programs, which support the user during input and output and enable the plotting of the generated data. (auth)

16523 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR FUEL ELEMENT SHEATHS. White, L.; Young, C. N. (to United Kingdom Atomic Energy Authority). British Patent 1,397,424/B/. 11 Jun 1975. Filed date 29 Feb 1972. 3p.

Reference is made to the heat transfer performance of cylindrical fuel element sheaths. Many suggestions have been made for improving the performance over that of a smooth surface, but the problem is that these suggestions usually involve more coolant blower power and also an increase in the amount of neutron absorbing material in the sheath, and economically these can cancel out the advantages of improved heat transfer. The fuel element described has a number of vortex-generating protuberances each shaped to operate solely on the boundary layer of coolant surrounding the fuel element and having a triangular plane surface inclined at an angle to the fuel element surface so as to provide a space behind the protuberances to accommodate the vortices produced by and sweeping over the leading edges of the protuberances. (UK)

16524 INTERFUEL: DEVELOPMENT OF FUEL FABRICATION TECHNIQUES. Atoomenerg. Haar Toepass.; 17: No. 10, 223-224(Oct 1975).

On July 5, 1972, an understanding was reached between Rijn-Schelde-Verolme NV(RSV), Shell Kernenergie NV, Gemeenschappelijke Kernenergiecentrale Nederland NV (GKN), Comprimo BV and Stichting Reactor Centrum Nederland (RCN), regarding the formation of a company to co-operate concerning the fuel cycle for nuclear reactors-special emphasis being given to the production of fuel elements for light water reactor systems. (NL)

16525 REVIEW OF EXPERIENCE WITH WATER REACTOR FUELS 1968-1973. Locke, D. H. (UKAEA Reactor Group, Springfields). Nucl. Eng. Des.; 33: No. 2, 94-124(Sep 1975).

This review of water reactor fuel performance from 1968 to 1973 shows that defect levels in Zircaloy-clad UO_2 fuels have, at times, been up to 1 in 3 bundles/reactor yr or approximately 1 in 100 pins. Among the consequences of such events, are considerable efforts by manufacturers, designers and operators to understand the mechanisms of defects. As a result it has been possible to feed back the operating experience to give improvements in defect level to approximately 1 in 200 bundles/reactor yr or between 1 in 10^3 and 1 in 10^4 fuel pins. The various types of defects and limiting features of Zircaloy clad fuel have been classified and fitted to well established reliability technology. There is justification for establishing a statistical data bank on water reactor fuel performance, to establish models and confirm acceptable defect levels, similar to those available on reactor plant. Few defects can yet be described as "life limiting" in that incore lifetime is currently decided on economic grounds. Some potential life-limiting features have been identified during the review which should be the subject of further work to improve the long term performance of water reactor fuel. (NL)

16526 INTERACTIONS BETWEEN FUEL PINS AND ASSEMBLY COMPONENTS. Pickman, D. O. (UKAEA Reactor Group, Springfields). Nucl. Eng. Des.; 33: No. 2, 125-140 (Sep 1975).

The structure of a fuel element has the primary function of holding fuel pins in a regular array throughout their irradiation life, and secondary functions of permitting loading and unloading operations and transportation to be carried out without damage. Differential thermal expansions, irradiation-induced dimensional changes and flow-induced phenomena have to be accommodated. These factors can lead to fuel pin damage and ultimate loss of cladding integrity or to distortions which may effect the thermal performance either in normal operation or in a loss-of-coolant accident. The various types of interaction that have been experienced, their consequences, and the design principles that should be followed to avoid them are discussed. (NL)

16527 INTERNAL CLADDING CORROSION EFFECTS. Pickman, D. O. (UKAEA Reactor Group, Springfields). Nucl. Eng. Des.; 33: No. 2, 141-154(Sep 1975).

Internal hydriding has been the most persistent cause of defects in water reactor fuel pins. The mechanism of heterogeneous internal hydriding, the effect of bore surface condition, the critical amount of hydrogen, and criteria by which it may be specified are discussed. Production methods for achieving low hydrogen content are examined. Other factors which contribute to the initiation of a leak path through the cladding are discussed. Attack by other impurities, including fission products is considered, and the attack of stressed zirconium alloys by iodine is shown to be capable of producing major cracks. Recommendations are made on measures to minimize its incidence. (NL)

16528 ZIRCALOY CLADDING MECHANICAL PROPERTIES. Hannerz, K.; Vesterlund, G. (Allmaenna Svenska Elektriska AB (ASEA), Vaesteraas). Nucl. Eng. Des.; 33: No. 2, 205-218 (Sep 1975).

Life-limiting aspects of the Zircaloy cladding material are discussed, with emphasis on the fuel-clad interaction type of failure. The tensile tests and creep properties and the changes of these due to neutron irradiation are reviewed. A section on high temperature properties of interest in loss-of-coolant accident (LOCA) analysis is also included. The paper is concluded with a discussion of the optimum choice of cladding material properties and the basis of the data reviewed. (NL)

16529 ZIRCALOY CLADDING TUBES: MANUFACTURING TECHNIQUES AND ACHIEVABLE QUALITY: A TUBE MANUFACTURER'S VIEW. Rose, R.; Lunde, K.; Aas, S. (Institutt for Atomenergi, Kjeller (Norway)). Nucl. Eng. Des.; 33: No. 2, 219-229(Sep 1975).

The behavior of the Zircaloy fuel cladding in water-cooled power reactors depends on a variety of properties determined during the cladding tube fabrication process. This does not necessarily imply that variations in the fabrication process will determine the fuel pin integrity, although the considerable number of tube specification changes introduced over the last few years may well be interpreted in that way. (NL)

16530 URANIUM DIOXIDE PROPERTIES FOR LWR FUEL RODS. Stehle, H.; Assmann, H.; Wunderlich, F. (Kraftwerk Union A. G., Erlangen (F. R. Germany)). Nucl. Eng. Des.; 33: No. 2, 230-260(Sep 1975).

127 refs.

Uranium dioxide pellets have become the most important nuclear fuel, and will remain so for a long time, with the fissile isotope ^{235}U being replaced by PuO_2 additions. This does not significantly change the pellet properties. Uranium dioxide properties affect fuel rod performance more than previously anticipated, because UO_2 pellets show a distinct response to irradiation, and because of mechanical and chemical interaction with cladding. Here elastic and plastic behaviour, fracturing, irradiation, densification, and dimensional behaviour under steady and power cycling conditions are mainly covered. (NL)

16531 THE EFFECTS OF LOAD-FOLLOWING OPERATION OF FUEL RODS. Aas, S. (Institutt for Atomenergi, Kjeller (Norway)). Nucl. Eng. Des.; 33: No. 2, 261-268(Sep 1975).

28 refs.

Load-following operation of a nuclear power station means changes in the heat output of individual fuel rods. Since the thermal coefficient of expansion of the fuel oxide is larger than that of the cladding, any increase in heat rate may lead to mechanical interaction between cladding and pellet. In this way, load-following operation, manipulation of control rods for any purpose, and shuffling of fuel are all actions which have the same effects on the fuel rods. This paper considers in detail the design and operational parameters which affect the magnitude of the interaction between fuel and cladding. It is clear that if the power increase is large enough, the cladding will fail. This

paper also considers the critical increase heat load and what can be done to avoid difficulties. Possible defect mechanisms are also reviewed. (NL)

16532 PROCEDURE FOR SEALING FUEL CANS. (to Interfuel B.V.). Netherlands Patent 7,403,481/A/. 15 Mar 1974. 9p. (In Dutch).

A method is described for sealing a fuel element on the end and in the middle by squeezing the fuel cans and welding them. The described process allows for welding more fuel cans at one time. (NL)

Reactor Control Systems

16533 (AEC-tr-7295, pp 124-129) COMPUTER-BASED AUTOMATIC CONTROL SYSTEM FOR LARGE ATOMIC POWER STATIONS. Greben'kov, Zh. A.; Saunin, E. V.; Tokar, M. S. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli i Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

Attempts to develop automatic control of nuclear power plants by use of computer-based integrated systems are examined. The basic functions entrusted to the computer and the main components of the control system are briefly discussed. (HDR)

16534 (KIYI-74-19) PERIOD METER ON SEMICONDUCTOR ELEMENTS FOR REACTOR CONTROL AND PROTECTION. Grinevich, F. A. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1974. 11p. (In Russian). INIS.

3 refs.; 3 figs.

A description is given of a transistorized periodmeter made in the form of a log differentiating amplifier. As the log element, use is made of 5 series-connected silicon diodes of the type D811 and one germanium diode of the type D311. Taking the log of the current over the range from 10^{-12} to 10^{-4} A is performed with an accuracy better than 2.5% per decade. The temperature drift of the logmeter in the region of temperature change from 10 to 40°C is less than ±0.003 units/°C. The measurement error of the period because of inlet signal noise and overshooting does not exceed 3.5%. The unit can be successfully used in a system of control and protection, and in devices for measuring the reactivity over a wide range of change in reactor power. (auth)

16535 (NP-20722) OECD HALDEN REACTOR PROJECT. Fifteenth Annual Report, 1974. (Organization for Economic Co-Operation and Development, 75 – Paris (France)). 1974. 104p. Dep. NTIS (US Sales Only) $6.50.

Information is presented concerning power reactor control methods and computer applications, fuel research and test fuel irradiation, reactor operations, and administration and finance. (DCC)

16536 NUCLEAR REACTOR. Andrews, H. N.; Frisch, E. (to Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). German (FRG) Patent 1,443,871/A/. 17 Apr 1975. 25p. (In German)

The control rods fastened to the vessel head of a nuclear reactor and which can thus be removed with the head are protected in the removal of the vessel head and its lay-down. For this there is a cylindrical component surrounding the ends of the control rods and jutting out past these which is used as support for the vessel head. The component is fixed to a plate which is held onto a further plate connected with the vessel head by supports where some of the supports are hollow and take up the control rods. The replacement of the vessel head is so designed that fuel element bundles of the reactor core have set pins with conical points for alignment and just into conical counter bores of the plate possessed by the component. Both plates can furthermore be aligned opposite supports of the core support structure. (DE)

16537 CONTROL SYSTEM FOR A NUCLEAR REACTOR. Dupen, C. F. G. (to Combustion Engineering, Inc., Windsor, Conn. (USA)). German(FRG) Patent 2,445,672/A/. 17 Apr 1975. 25p. (In German)

Guide distortions are accomodated and jamming of absorber elements in the guide are prevented with the control rod system for a nuclear reactor core in which fast neutrons are used for the chain reactions. The absorber elements are hung on a central rotating support. When introducing in a downwards direction, the absorber rods are moved in such a manner that the minimum distance from the side between the absorber rods and the inner wall of the guide is increased. The group of absorber rods is thus attached in such a way that it compresses with this downward movement. Supporting arms can be used for this which are rotationally mounted on the support. They spread out sideways and are flexibly fixed. A T-piece ball-and-socket joint or a shackle toggle joint is used as attachment. In the upward motion, the absorber rods return by themselves to their starting position. (DE)

16538 COMPARATIVE ANALYSIS OF NUCLEAR REACTOR CONTROL SYSTEM DESIGNS. Russcher, G. E. (Hanford Engineering Development Lab., Richland, WA). pp 502-511 of Proceedings of U. S. National Conference on Earthquake Engineering 1975. Oakland, CA; Earthquake Engineering Research Institute (1975).

From U. S. national conference on earthquake engineering; Ann Arbor, Michigan, USA (18 Jun 1975). See CONF-7506107-.

Control systems are vital to the safe operation of nuclear reactors. Their seismic design requirements are some of the most important criteria governing reactor system design evaluation. Consequently, the seismic analysis for nuclear reactors is directed to include not only the mechanical and structural seismic capabilities of a reactor, but the control system functional requirements as well. In the study described, an alternate conceptual design of a safety rod system was compared with a prototypic system design to assess their relative functional reliabilities under design seismic conditions. The comparative methods utilized standard success tree and decision tree techniques to determine the relative figures of merit. The study showed: (1) The methodology utilized can provide both qualitative and quantitative bases for design decisions regarding seismic functional capabilities of two systems under comparison, (2) the process emphasizes the visibility of particular design features that are subject to common mode failure while under seismic loading, and (3) minimal improvement was shown to be available in overall system seismic performance of an independent conceptual design, however, it also showed the system would be subject to a new set of operational uncertainties which would have to be resolved by extensive development programs. (auth)

Nuclear Power Plant Economics

16539 (AEC-tr-7295, pp 130-136) PART-LOAD PERFORMANCE OF POWER STATIONS WITH CHEMICALLY REACTING WORKING FLUID. Mikhal'tsev, V. E.; Surovtsev, I. G.; Yakavlev, V. Ya. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli I Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

Regulation of the power output of a power station operating with N_2O_4 as the working fluid is examined. The efficiencies of two regulation methods are compared. It is concluded that regulation by reducing the inlet temperature of gas to the turbine is less economical than maintaining constant turbine inlet temperatures but transferring a portion of the working fluid to accumulators. (HDR)

16540 (AEC-tr-7295, pp 137-142) OPTIMIZATION OF THE PROCESS OF SHUT-DOWN COOLING OF REACTOR. Sharovarov, G. A.; Sadchikov, V. I. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli I Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki).

An optimum after-heat removal system is proposed to assure minimum energy requirements for the system. Equations are presented for determining the time dependent coolant flow rates through the core and the heat exchanger circuit. (HDR)

16541 (AEC-tr-7295, pp 143-147) TURBOGENERATOR SPEED REGULATION BY MEANS OF VARIABLE-PITCH PROPELLER. Kamenskaya, Zh. V.; Pavlin, I. M.; Sharovarov, G. A. 1975. Translated from Dissotsiiruyushchie Gazy Kak Teplonositeli I Rabochie Tela Energeticheskikh Ustanovok, Nauka and Tekhnika Press, Minsk, 1970.

From all-union conference on dissociating gases as heat transfer media and working fluids in power installations; Minsk, USSR (27 Jan 1969).

In dissociating gases as heat-transfer media and working fluids in power installations. (AN Belorusskoj SSR, Minsk, Inst. Yadernoj Ehnergetiki).

A scheme is proposed for the valveless regulation of turbogenerator speed by use of a variable-pitch propeller (VPP) to increase or decrease the turbine power consumed by the propeller. In addition, the VPP serves as a fan to air cool the condenser. (HDR)

16542 (INIS-mf-1782) ANALYSIS OF ELECTRIC POWER IN ARGENTINA. Csik, B. J.; Marrere, H. M.; Sarraillet, H. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). Dec 1973. 57p. (In Spanish). INIS.

By means of a series of comparative data, statistical studies, and data from various fields, the present and future electric power situation in Argentina is analyzed. The periods from 1974-1980 and 1980-1990 are concentrated upon. An analysis is made of the fuel needs from 1974 to 1990 and their costs. It is estimated that the construction of hydroelectric and nuclear power plants will require large investment but result in lower operating costs and decrease the investment in the conventional fuel sector, particularly petroleum. (JSR)

16543 DYNAMIC ENERGY ANALYSIS AND NUCLEAR POWER. Price, J. London; Friends of the Earth for Earth Resources Research (1974). 30p. £1.00.

An initial inquiry (intended for the layman) into how the net energy balance of exponential programs of energy conversion facilities varies in time; what are the energy inputs and outputs of commercial nuclear reactors, both singly and in such programs; what are the possible errors and omissions in this analysis; and what are the policy and research implications of the results. (auth)

16544 INFLUENCE OF NETWORK DEMANDS ON POWER PLANT OPERATION. Spalthoff, F. J. (Rheinisch-Westfaelisches Elektrizitaetswerk A. G., Essen (F. R. Germany)). pp 151-162 of Power Plant Engineering. Reliability Enhancement and Operation Optimization. Koeln, F. R. Germany; TUeV Rheinland (1974). (In German)

From symposium "Power plant engineering—Reliability enhancement and operation optimization"; Bad Neuenahr, F. R. Germany (7 Oct 1974). 9 figs.; 4 refs.

The demands which are made by the user on an energy generation system are investigated and thoughts on the provision of the energy needed as well as procuring the supply are put forward. The consequences of these user demands upon generating units in power plants and the technical possibilities to meet these requirements are explained. The study ends with prospects of feasible developments through modern information systems. (DE)

16545 MAINTENANCE OF POWER PLANTS. Fehndrich, W.; Hinterthan, W. (Rheinisch-Westfaelisches Elektrizitaetswerk A. G., Essen (F. R. Germany)). pp 23-45 of Power Plant Engineering. Reliability Enhancement and Operation Optimization. Koeln, F. R. Germany; TUeV Rheinland (1974). (In German)

From symposium "Power plant engineering—Reliability enhancement and operation optimization"; Bad Neuenahr, F. R. Germany (7 Oct 1974). 23 figs.; 12 refs.

Organizational conditions and the practical implementation of maintenance in the RWE-Bayernwerk reactor are discussed. Besides these explanations which arise from practical use some supplementary theoretical considerations about failure characteristics and failure rates are contemplated as well as the influence regular maintenance bears on availability and costs. (DE)

16546 OPTIMIZATION OF POWER PLANT START UP AND SHUTDOWN. Stekl, J. (Technischer Ueberwachungs-Verein Rheinland e.V., Koeln (F. R. Germany). Gruppe Betriebsoptimierung). pp 201-212 of Power Plant Engineering. Reliability Enhancement and Operation Optimization. Koeln, F. R. Germany; TUeV Rheinland (1974). (In German)

From symposium "Power plant engineering—Reliability enhancement and operation optimization"; Bad Neuenahr, F. R. Germany (7 Oct 1974). 11 figs.; 20 refs.

The frequent start-ups and shut-downs of the installations in power plants have made it necessary to optimize these operations. A suitable optimization method which leads to the drawing-up of a universal startup diagram dependent only on the temperature of the installation is described. (DE)

16547 ELECTRICITY AND HIGH-TEMPERATURE HEAT FROM NUCLEAR POWER. Throm, W. pp 85-91 of Secure Energy—Save Energy. A Practical Handbook for All Users and Producers of Energy. Sterner, S. (ed.). Duesseldorf, F. R. Germany; Econ (1975). (In German)

A popularized survey on the situation and prospects of nuclear energy is presented. (DE)

16548 SOME ACTUAL INFLUENCES ON THE POWER PLANT ENGINEERING IN THE FEDERAL REPUBLIC OF GERMANY. Meyer, E. BBC-Nachr.; 57: No. 5/6, 223-231(1975). (In German) 7 figs.

The basic demands on the power supply industry are described and individual tasks are discussed, e.g., that of environmental protection, showing the impact of official requirements in this field. The necessity and possibilities of saving energy are examined. Finally, the efforts made to design and construct nuclear power stations to ensure not only safe but also economical operation are discussed. (DE)

Reactor Fuel Cycle Economics

Refer also to abstracts 14361—14364 and 16302.

16549 (CONF-750867-, pp 130-142) SIMULATION METHODS FOR NUCLEAR PRODUCTION SCHEDULING. Miles, W. T.; Markel, L. C. (Systems Control Inc., Palo Alto, CA). 1975.

From proceedings on systems engineering for power; Henniker, New Hampshire, USA (17 Aug 1975).

In systems engineering for power: status and prospects, Henniker, New Hampshire, August 17-22, 1975. (Energy Research and Development Administration, Washington, D.C. (USA)).

Recent developments and applications of simulation methods for use in nuclear production scheduling and fuel management are reviewed. The unique characteristics of the nuclear fuel cycle as they relate to the overall optimization of a mixed nuclear-fossil system in both the short-and mid-range time frame are described. Emphasis is placed on the various formulations and approaches to the mid-range planning problem, whose objective is the determination of an optimal (least cost) system operation strategy over a multi-year planning horizon. The decomposition of the mid-range problem into power system simulation, reactor core simulation and nuclear fuel management optimization, and system integration models is discussed. Present utility practices, requirements, and research trends are described. 37 references. (auth)

16550 (CONF-751101-54) APPLICATION OF THE THORIUM FUEL CYCLE. Kasten, P. P.; Tobias, M. L. (Oak Ridge National Lab., Tenn. (USA)). 1975. 6p. Dep. NTIS $4.50.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum; San Francisco, California, USA (16 Nov 1975).

An economic analysis of the application of the thorium fuel cycle to thermal reactors is presented. (JWR)

16551 PLUTONIUM FUEL CYCLES. Pigford, T. H.; Ang, K. P. (Univ. of California, Berkeley). Health Phys.; 29: No. 4, 451-468(Oct 1975).

From Plutonium: health implications for man. Proceedings of the second Los Alamos life sciences symposium; Los Alamos, NM, USA (22 May 1974).

The quantities of plutonium and other fuel actinides have been calculated for equilibrium fuel cycles for 1000-MW water reactors fueled with slightly enriched uranium, water reactors fueled with plutonium and natural uranium, fast-breeder reactors, gas-cooled reactors fueled with thorium and highly enriched uranium, and gas-cooled reactors fueled with thorium, plutonium and recycled uranium. The radioactivity quantities of plutonium, americium and curium processed yearly in these fuel cycles are greatest for the water reactors fueled with natural uranium and recycled plutonium. The total amount of actinides processed is calculated for the predicted future growth of the U. S. nuclear power industry. For the same total installed nuclear power capacity, the introduction of the plutonium breeder has little effect upon the total amount of plutonium processed in this century. The estimated amount of plutonium in the low-level process wastes in the plutonium fuel cycles is comparable to the amount of plutonium in the high-level fission product wastes. The amount of plutonium processed in the nuclear fuel cycles can be considerably reduced by using gas-cooled reactors to consume plutonium produced in uranium-fueled water reactors. These and other reactors dedicated for plutonium utilization could be co-located with facilities for fuel reprocessing and fuel fabrication to eliminate the off-site transport of separated plutonium. (auth)

16552 FUTURE OF PLUTONIUM: AN OVERVIEW. Larson, C. E. (Energy Research and Development Administration, Washington, DC). Health Phys.; 29: No. 4, 443-450(Oct 1975).

From Plutonium: health implications for man. Proceedings of the second Los Alamos life sciences symposium; Los Alamos, NM, USA (22 May 1974).

Plutonium is the underpinning of the nuclear industry. Without it it is estimated that the fuel will run out not long after the turn of the century. With plutonium in fast breeders nuclear reactors can be operated for tens of thousands of years and the depleted uranium now available can be utilized. The fuel cycle contemplated

is similar to that of the light water reactor with some important differences at least partially related to the greater radioactivity of the resulting mixture of plutonium isotopes. The regulatory program does recognize the problems, including those of toxicity, safeguards and transportation. The concept of an integrated fuel cycle facility at a single location must be seriously considered. (auth)

16553 PEACEFUL USES OF NUCLEAR POWER, NUCLEAR FUEL CYCLE. Motion by the Members of Parliament Lenzer, Pfeffermann, Benz, Engelsberger, Franz, Roser, Spies von Buellesheim, Stavenhagen, Walz and Fellow Members. Bundesrat–Drucksache; 7: No. 3827, 1-5(Jun 1975). (In German)

With this petition which contains detailed questions on all stages of the nuclear fuel cycle, the Federal Government is called upon to submit a report giving information on the envisaged ways of overcoming the problems of the fuel cycle to the Bundesrat by the 1st of January, 1976. (DE)

Reactor Licensing and Regulation

16554 (CPC-1(Rev.3)(Vol.1)) QUALITY ASSURANCE PROGRAM MANUAL FOR NUCLEAR POWER PLANTS. Volume I. Policies. (Consumers Power Co., Jackson, Mich. (USA)). 1 Dec 1975. 140p. Consumers Power Co., Jackson, MI.

Policies and procedures are presented which comply with current NRC regulatory requirements and industry codes and standards in effect during the design, procurement, construction, testing, operation, refueling, maintenance, repair and modification activities associated with nuclear power plants. Specific NRC and industry documents that contain the requirements, including the issue dates in effect, are identified in each nuclear power plant's Safety Analysis Report. The requirements established by these documents form the basis for the Consumers Power Quality Assurance Program, which is implemented to control those structures, systems, components and operational safety actions listed in each nuclear power plant's Quality List (Q-List). As additional and revised requirements are issued by the NRC and professional organizations involved in nuclear activities, they will be reviewed for their impact on this manual, and changes will be made where considered necessary. (auth)

16555 (DOCKET-50366-110) EDWIN I. HATCH NUCLEAR PLANT, UNIT 2. License Application, General Information. (Georgia Power Co., Atlanta (USA)). 20 Oct 1975. 87p. Dep. NTIS $6.00.

An application for a direct cycle BWR is presented. The reactor will be located about 11 miles north of Baxley, Ga., near the south bank of the Ultamaha River in Appling County close to Hatch-1 Reactor. The core thermal power level will be 2537 MW(t) and the electrical power level will be 795 MW(e). Mechanical cooling towers will be utilized. (FS)

16556 (NRCI-75/10) NUCLEAR REGULATORY COMMISSION ISSUANCES, OCTOBER 1975. (Nuclear Regulatory Commission, Washington, D. C. (USA)). Dec 1975. 101p. TIC $4.00.

Issuances of the Atomic Safety and Licensing Appeal Boards and the Atomic Safety and Licensing Boards are presented. No Nuclear Regulatory Commission issuances were submitted. (HDR)

16557 (RDT-INDEX-1-76(Suppl.)) INDEX OF RDT STANDARDS. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). 5 Jan 1976. RSO.

An index of new and revised RDT Standards is presented. (DCC)

16558 (REG/G-1.101(11-75)) EMERGENCY PLANNING FOR NUCLEAR POWER PLANTS. (Nuclear Regulatory Commission, Washington, D. C. (USA). Office of Standards Development). Nov 1975. 14p. NUREG.

This regulatory guide provides more complete guidance in developing emergency plans for nuclear power plants. It describes a method acceptable to the NRC staff for complying with the Commission's regulations with regard to adequate content of emergency plans for nuclear power plants, primarily in the FSAR stage. (auth)

16559 (REG/G-1.35(Rev. 2)) INSERVICE INSPECTION OF UNGROUTED TENDONS IN PRESTRESSED CONCRETE CONTAINMENT STRUCTURES. (Nuclear Regulatory Commission, Washington, D.C. (USA). Office of Standards Development). Jan 1976. 4p. NUREG.

None

16560 (REG/G-1.84(Rev.4)(11-75)) CODE CASE ACCEPTABILITY: ASME SECTION III DESIGN AND FABRICATION. (Nuclear Regulatory Commission, Washington, D.C. (USA). Office of Standards Development). Nov 1975. 6p. NUREG.

This regulatory guide lists those Section III ASME Code Cases oriented to design and fabrication that are generally acceptable to the NRC staff for implementation in the licensing of light-water-cooled nuclear power plants. (DLC)

16561 (REG/G-1.85(Rev.4)(11-75)) CODE CASE ACCEPTABILITY: ASME SECTION III MATERIALS. (Nuclear Regulatory Commission, Washington, D.C. (USA). Office of Standards Development). Nov 1975. 6p. NUREG.

This regulatory guide lists those Section III ASME Code Cases oriented to materials and testing that are generally acceptable to the NRC staff for implementation in the licensing of light-water-cooled nuclear power plants. (DLC)

16562 CASE FOR TAX-EXEMPT BOND FINANCING OF POLLUTION CONTROL FACILITIES AT NUCLEAR POWER PLANTS. Fox, H. L.; Rindler, R. M.; Wilson, E. G. (Pepper, Hamilton and Scheetz, Washington, DC). At. Energy Law J.; 17: No. 1, 3-76(Spr 1975).

Legal aspects of bond financing of nuclear power plant pollution control facilities are discussed in sections dealing with tax incentives, legislative analysis, application of existing regulations to a PWR plant, and a summary of those PWR pollution control facilities that should qualify for tax-exempt financing. (DG)

16563 SPEEDING UP THE NUCLEAR LICENSING PROCEDURE. Danzmann, H. J. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F. R. Germany)). IRS Mitt.; 75: No. 1, 19-26(Mar 1975). (In German)

Some of the factors which make a nuclear licensing speed up necessary are specified: security of the power supply, the need to fulfil the Federal Government's energy program, the benefit to national economy, and the interests of operators and producers. The responsible authority, i.e., the Federal Ministry of the Interior, has developed a concept to improve the licensing procedure. Some of the possibilities are discussed: better public relations, higher safety levels, standardized plants, prefabrication of construction parts, coordination of experts opinions, timely planning on the part of the power plant operators and the Federal Lands, standardization and shortening of the procedure. (DE)

16564 THE DEVELOPMENT OF NUCLEAR ENERGY LAW. Legal Practice and Changes. Scheuten, G. H. (Rheinisch-Westfaelisches Elektrizitaetswerk A. G., Essen (F. R. Germany)). Elektrizitaetswirtschaft; 74: No. 16, 575-582(Aug 1975). (In German)

From VDEW meeting; Hamburg, F. R. Germany (3 Jun 1975).

It is observed that the present atomic energy laws and the regulations embodied therein do not only represent the basis for a successful nuclear energy economy which is in the process of being built up, but that these laws are also consequential for the development of safety standards, exemplary to the whole world. In view of the importance of nuclear energy for the future development of national economy on the one side, but also with regard to the increased social/political relevance on the other, those developments which signal a new trend in the general opinion of the law—a trend which signals changes—are investigated and dealt with keeping the reflections of the legislator in mind. (DE)

16565 VGE-EMPFEHLUNGEN. Deformationsmessungen im Kraftwerksbau. (VGB Recommendations. Deformation Measurements in Nuclear Power Stations). Essen, F. R. Germany; VGB (1975). 11p. (In German)

Definitions, methods of measurement, and recommendations for the performance of deformation measurements in nuclear power stations are given. (DE)

16566 TECHNICAL COMPETENCE INDEX FOR PERSONNEL IN NUCLEAR POWER STATIONS. Fechner, J. B. (Bundesministerium des Innern, Bonn (F. R. Germany). Referat Regeln und Richtlinien); Wildberg, D. W. (Technischer Ueberwachungs-Verein Baden e.V., Mannheim (F. R. Germany). Abt. Kerntechnik und Strahlenschutz). At. Strom; 21: No. 7, 78-81 (Jul 1975). (In German)

12 refs.

In October 1974, the guidelines for the technical competence index for nuclear power station personnel was approved in the provincial committee for atomic energy. Comments are presented on the first experience with the application of the guidelines to the technical competence index for the operating personnel in the installations of the Philippsburg nuclear station (KKP 1) and in the Neckar cooperative nuclear station (GKN) in the province of Baden-Wuerttemberg. The experience obtained so far shows that application of this regulation would give a practical standardization satisfactory to all sides for the technical com-

petence index of nuclear power station personnel in the German Federal Republic. (DE)

16567 SITE SELECTION FOR NUCLEAR POWER PLANTS. From the Question Time of the German Bundestag. Parliament; 25: No. 9, 12(1975). (In German)

An answer of the Parliamentary Secretary of State at the Federal Ministry of the Interior is presented to the question of what competence the Federal State has in the site selection for a nuclear power plant. (DE)

16568 MAIN PRIMARY COOLANT CIRCUITS OF LIGHT WATER REACTORS. Koeln, F. R. Germany; IRS (1975). 58p. (In German)

Also published in J. Off. Repub. Fr. (Mar 1974) v. 12.

A French decree on the application of the regulations for steam pressure systems in the primary coolant circuit of light-water reactors is presented. (DE)

16569 SEISMIC DESIGN OF NUCLEAR POWER PLANTS. I. Fundamentals. Draft 6/75. IRS Kurz-Inf., Reihe C; 26: No. 14, 1-4(1975). (In German)

1 fig., 6 refs.

The regulation applies primarily to the layout of all stationary nuclear power stations in the FRG, but it should also provide a regulatory guide for the design of all other nuclear facilities. It contains definitions of design basis earthquakes and safe shutdown earthquakes, determination of design basis earthquakes (earthquake zones, seismic engineering data), a classification of plant structural components, definitions of loads and load combinations, calculations, strains and deformations, and seismic instruments effects of the safe shutdown earthquake on the site (foundation soil, environment). (DE)

16570 KERNTECHNISCHE ANLAGEN: ROHRLEITUNGEN. Auslegung, Herstellung, Pruefung. Entwurf. (Nuclear Facilities: Piping. Design, Manufacture, Testing. Draft). Berlin, F. R. Germany; Beuth (Sep 1973). 24p. (In German). (DIN-25408).

7 tabs.

This draft standard applies to pipes in nuclear facilities, especially in nuclear power stations, research reactors, hot cells, fuel reprocessing plants, storage facilities for radioactive wastes, fuel enrichment plants, and fuel element production facilities. The joints between the pipes and components must satisfy the minimum requirements made by this draft standard. (DE)

GENERAL AND MISCELLANEOUS

Information Handling

16571 KERNTECHNIK. Begriffe (7. Ergaenzung zu DIN 25401). (Nuclear Technology. Terms and Definitions (7. Supplement to DIN 25401)). Berlin, F. R. Germany; Beuth (May 1973). 23p. (In German). (DIN-25401(B1.16)).

This 8th volume of terms and definitions has for the most part been included in ISO/TC85/SC1. The terms are in German, English, French, Russian, Italian and Dutch, the definitions in German and English. (DE)

Law

16572 ACT ON THE TRANSPORT OF HARMFUL SUBSTANCES. Bundesgesetzblatt, Teil 2; 1975: No. 95, 2121-2126 (Aug 1975). (In German)

The law applies to the transport by rail, roads, over water, and by air. It does not apply in factories, within the province of the Federal Postal Administration in the transport across borders where bilateral or international agreements or regulations are applicable, and in mountain railways. (DE)

Management

16573 (CONF-710994-P3, pp 105-113) ACTIVITIES AND STRUCTURE OF THE CENTER FOR SCIENTIFIC AND TECHNICAL INFORMATION OF THE CAEC. Hajicek, J. (VZUP, Zbraslav nad Vltavou, Czech.). 1971. (In Czech).

From 5th scientific conference of the institute of mining and metallurgy; Ostrava, Czechoslovakia (14 Sep 1971).

In fifth scientific conference VSB. Vol. III.

A brief description is given of the organizational structure of the CAEC Centre for Scientific and Technical Information, of the activities of its respective departments, and of the Centre's efforts in view of Czechoslovakia's membership in the International Nuclear Information System. (INIS)

16574 (COO-3368-6) NUCLEAR SCIENCE: A SURVEY OF FUNDING, FACILITIES, AND MANPOWER. (National Academy of Sciences - National Research Council, Washington, D. C. (USA)). 1975. 138p. Dep. NTIS $6.00.

In 1973 the Committee on Nuclear Science of the National Research Council initiated a re-examination of aspects (funding, manpower, and facilities) of the organization and operation of nuclear science research in order to evaluate any changes in the preceding four years and implications of such changes. The reports of the three ad hoc panels established for this purpose (funding and level of effort, nuclear facilities, manpower and education) are presented. Although they identify current problems in nuclear science, these reports do not provide simple solutions; rather, they attempt to provide updated information for use as background for continuing decisions. (RWR)

16575 (ERDA-98) HIGH ENERGY PHYSICISTS AND GRADUATE STUDENTS, 1975 CENSUS. (Energy Research and Development Administration, Washington, D. C. (USA)). Nov 1975. 358p. Dep. NTIS $10.60.

This listing of physicists and students associated with the U. S. high energy physics program has been compiled in the Office of the Assistant Director for High Energy Physics of the Division of Physical Research of the U. S. Energy Research and Development Administration. This listing has been obtained by asking the research groups, laboratories, and other agencies involved to update our previous listing. We would like to take this opportunity to thank the many contributors who assisted in submitting information. In addition, we would like to thank the National Science Foundation program office for their assistance in obtaining information on their grantees. This listing is in two parts. The first part is an alphabetical listing and includes only the name, rank, and institution of high-energy physicists and graduate students. The second part of the listing is arranged by institution. Within each institution, the faculty (or permanent staff) and the graduate students are presented in separate alphabetical lists. For each person, the entry indicates his birthdate, the year and institution of his highest degree, his rank and institutional affiliation with starting dates, up to three items selected from a list of research specialties, and his sources of federal support. For the graduate students, there is indicated an estimated date for degree reception. Where appropriate, a person is listed at more than one institution. Except as noted in the listings, the information is intended to indicate the situation as of January 1, 1975. (RWR)

16576 (EUR-5372e) SYSTEMS ANALYSIS AS A TOOL FOR OPTIMAL PROCESS STRATEGY. Ditterich, K.; Schneider, J. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1975. 36p. Dep. NTIS (US Sales Only) $5.00. EUR FB 110,-.

For the description and the optimal treatment of complex processes, the methods of systems analysis are used as the most promising approach in recent times. In general every process should be optimized with respect to reliability, safety, economy, and environmental pollution. In this paper the complex relations between these general optimization postulates are established in qualitative form. These general trend relations have to be quantified for every particular system studied in practice. (11 figures) (auth)

16577 (HMI-185) ANNUAL REPORT, 1974. Maass, K. E. (ed.). (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (F. R. Germany)). 1975. 75p. (In German).

The administrative report is divided into the following sections: foreword; introduction; general development; scientific areas; joint scientific-technical organization; cooperation, coordination, and contracts; and transfer of results. (RWR)

16578 PROGRAM BUDGET OF THE HMI FOR THE YEAR 1975 (EXCERPT). Technol. Nachr. Programm-Inf.; No. 115, 9-14(Jun 1975). (In German)

A summary is given of the HMI program budget for the year 1975 in the fields of nuclear and atomic physics, radiation chemistry, nuclear chemistry, data processing, and electronics. (DE)

Mathematics and Computers

Refer also to abstracts 14845, 14922, 14978, 14982, and 15909.

16579 (COO-3077-97) PROGRESS REPORT NO. 51, JULY 1, 1974-JUNE 30, 1975. Technical Summary. (New York Univ., N. Y. (USA). Courant Inst. of Mathematical Sciences). 1 Nov 1975. Contract E(11-1)-3077. 31p. Dep. NTIS $4.50.

Research work in the following areas is briefly reviewed: applied mathematics and mechanics (computational fluid dynamics, controlled thermonuclear research, numerical analysis); computational physics, chemistry, and biology; computer science research (computer netting; programing languages and compilers; operating systems, micro-processor networks, and modular systems); and systems programing, user services, and hardware support. A list of publications is also given. (RWR)

16580 (JINR-R-5-8547) STABILITY OF INITIAL BOUNDARY VALUE PROBLEMS FOR SYSTEMS OF NONUNIFORM DIFFERENCE EQUATIONS. Serdyukova, S. I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 12p. (In Russian). INIS.

4 refs.; submitted to the journal USSR Comput. Math. Math. Phys.

By means of a stability criterion of boundary problems obtained previously for difference equations of similar structure a stability criterion is obtained for a class of systems of difference equations of different structure. (tr-SJR)

16581 PRACTICAL HANDLING OF THE FINITE ELEMENT METHOD. II. Stelzer, F. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Zentralabteilung Allgemeine Technologie). Kerntechnik; 17: No. 8, 364-370(Aug 1975). (In English, German)

9 figs.; 4 refs.

The path from the differential equation to the equations for a finite element (element matrix) were described in Part 1, (Kerntechnik 7, 1975, p. 324). The extension of the element equation to a continuum is given. The paper can also be understood on its own. It is of particular use for those knowing the element matrices of their problem or taking them from the literature. (DE)

16582 APPLICATIONS OF NEUTRONS AND USE OF NEUTRON SOURCES. Hannappel, L.; Schneider, H. (Giessen Univ. (F. R. Germany). Abt. Grossgeraete (Angewandte Kernphysik)). Kerntechnik; 17: No. 8, 350-354(Aug 1975). (In German)

11 refs.; 1 tab.

This paper reports on applications of neutrons and on uses of neutron sources in some areas of research, industry and medicine, for example, in nuclear structure studies by means of neutrons, neutron activation analysis and neutron therapy. The discussion is based chiefly on low voltage ion accelerators, as strong sources of fast neutrons, and on pulsed accelerators with comparative references to other accelerator types and to nuclear reactors as neutron sources. References to more detailed literature are given. (DE)

COMPLETE OR PARTIAL COLLECTIONS OF ERDA REPORTS IN COUNTRIES OTHER THAN THE UNITED STATES

ARGENTINA
Buenos Aires, Comisión Nacional de Energía Atómica

AUSTRALIA
Canberra, National Library of Australia
Sutherland, New South Wales Atomic Energy Research Establishment

AUSTRIA
Vienna, International Atomic Energy Agency (IAEA)
Vienna, Zentralbibliothek der Physikalischen Institute der Universität

BELGIUM
Brussels, European Atomic Energy Community (Euratom)
Mol-Donk, Centre d'Etude de l'Energie Nucléaire

BRAZIL
Rio de Janeiro, Comissão Nacional de Energia Nuclear
São Paulo, Instituto de Energia Atómica

CANADA
Chalk River, Ontario, Atomic Energy of Canada, Ltd.
Hamilton, Ontario, McMaster University
Ottawa, National Research Council

CONGO, REPUBLIC OF
Kinshasa, Trico Nuclear Center

DENMARK
Risö, Danish Atomic Energy Commission

FINLAND
Otaniemi, Teknillinen Korkeakoulu

FRANCE
Saclay, Gif-sur-Yvette, Centre d'Etudes Nucléaires de Saclay

GERMANY, WEST
Karlsruhe, Zentralstelle für Atomkernenergie Dokumentation
Munich, Technische Universität

GREECE
Athens, Nuclear Research Center, Democritus Library

INDIA
Bombay, Trombay, Bhabha Atomic Research Center Library

IRAQ, REPUBLIC OF
Baghdad, Atomic Energy Commission, Nuclear Research Institute

IRELAND
Dublin, University College

ISRAEL
Yavne, Israel Atomic Energy Commission, Soreq Nuclear Research Centre

ITALY
Ispra, Cetis Library
Rome, Centro di Studi Nucleari della Casaccia

JAPAN
Tokyo, National Diet Library
Tokai-Mura, Naka-gun, Ibaraki-ken, Japan Atomic Energy Research Institute

KOREA, REPUBLIC OF
Seoul, Atomic Energy Research Institute

MEXICO
Mexico, D. F., Comisión Nacional de Energía Nuclear

NETHERLANDS, THE
Petten, Reactor Centrum Nederland
The Hague, Bibliothek Octrooiraad

NORWAY
Kjeller, Institutt for Atomenergi

PORTUGAL
Sacavem, Junta de Energia Nuclear

SOUTH AFRICA, REPUBLIC OF
Pretoria, Atomic Energy Board Library

SPAIN
Madrid, Junta de Energía Nuclear, Ciudad Universitaria

SWEDEN
Nyköping, Aktiebolaget Atomenergi Library

SWITZERLAND
Zürich, Swiss Federal Institute of Technology

UNITED KINGDOM
Boston Spa, Wetherby, Yorkshire, British Library Lending Division
Harwell, Didcot, Berkshire, Atomic Energy Research Establishment

IN INTERNATIONAL AGENCIES

EUROPEAN ATOMIC ENERGY COMMUNITY (EURATOM)
Brussels, Belgium
Ispra, Varese, Italy, Cetis Library

OECD NUCLEAR ENERGY AGENCY (NEA)
British Library Lending Division
Boston Spa, Wetherby, Yorkshire, England

INTERNATIONAL ATOMIC ENERGY AGENCY (IAEA)
Vienna, Austria

UNITED STATES
GOVERNMENT PRINTING OFFICE

POSTAGE AND FEES PAID
ERNMENT PRINTING OFFICE

U.S.MAIL

UNITED STATES ENERGY RESEARCH
AND DEVELOPMENT ADMINISTRATION
P. O. BOX 62
OAK RIDGE, TENNESSEE 37830

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

POSTAGE AND FEES PAID
U. S. ENERGY RESEARCH
AND DEVELOPMENT ADMINISTRATION

U.S.MAIL

XEROX UNIVERSITY MICROFILMS 1
SERIALS DEPT.
300 N. ZEEB ROAD
ANN ARBOR, MI 48106

Fiche Index for Nuclear Dockets

Dockets submitted to the U. S. Nuclear Regulatory Commission (NRC) in support of applications for construction permits and operating licenses for civilian nuclear power plants are made publicly available in microfiche form. Because microfiche are numbered and issued in random order and because the volume of material pertaining to any one power plant is large, locating specific information within a microfiche set is difficult. For this reason, logical and sequential tables of contents and/or indexes are constructed from the original material, relating the location of this material to specific microfiche and to specific grid coordinates. *FIND* indexes for more than 100 commercial nuclear power plants have been prepared for NRC by the Energy Research and Development Administration, Office of Public Affairs, Technical Information Center, Oak Ridge, Tennessee. A list of completed *FIND's* is available on request from the ERDA Technical Information Center, P. O. Box 62, Oak Ridge TN 37830.

Individual *FIND's* are for sale by the National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22161.